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Initialled abstracts and reviews in this number are by C. Oppenheimer of the Rehovoth Agricultural Research Station, Palestine, and by N. B. Bagenal, J. K. Eaton, S. C. Pearce and W. S. Rogers of the East Malling Research Station.

INDEX OF CONTENTS.

MISCELLANEOUS	Nos. 1272-1304
Plant hormones	1272-1284
Chemical analysis	1285-1290
Hydroponics	1291-1292
General	1293-1304
TREE FRUITS, DECIDUOUS	1305-1335
General	1305-1308
Breeding and selection	1309-1310
Propagation	1311-1313
Rootstocks	1314-1318
Root growth	1319
Pollination	1320
Growth and nutrition	1321-1322
Soils, manures and orchard practice	1323-1335
SMALL FRUITS, VINES AND NUTS	1336-1350
PLANT PROTECTION OF DECIDUOUS FRUITS	1351-1378
VEGETABLE GROWING	1379-1400
FLOWER GROWING	1401-1405
CITRUS AND SUB-TROPICALS	1406-1427
TROPICAL CROPS	1428-1510
STORAGE	1511-1524
PROCESSING AND PLANT PRODUCTS	1525-1542
NOTES ON BOOKS AND REPORTS	1543-1589

Horticultural Abstracts

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MISCELLANEOUS.

*Plant hormones.**

1272. PLANT, W. 577.15.04

The role of growth substances in the regeneration of root cuttings.

Ann. Bot., Lond., 1940, 4: 607-15, bibl. 15.

Full descriptions are given of experiments with seakale at Reading [see also *Nature*, 1938, 142: 293; *H.A.*, 9: 362] and a further attempt is made to elucidate the hormone theory of plant polarity in relation to root cuttings. Results obtained are well shown in plate figures.

1273. DENNISON, R. 577.15.04

Growth response of plants to riboflavin and ascorbic acid.

Science, 1940, 92: 17.

Trials at the University of Iowa with egg plant and tobacco showed that the addition of 2.5 p.p.m. synthetic (Merck) riboflavin to the nutrient solution of egg plant and of 10 p.p.m. synthetic (Merck) ascorbic acid to the nutrient solution of tobacco resulted in increased growth in both cases. Initial gains were maintained throughout the experiment.

1274. ARNON, D. I. 577.16: 577.15.04

Vitamin B₁ in relation to the growth of green plants.

Science, 1940, 92: 264-6, bibl. 11.

Tomato, lettuce, cosmos, mustard and cocklebur were grown in complete nutrient solutions with and without the addition of vitamin B₁ added in concentrations of 0.01 mg. or 0.05 mg. per litre of solution and the effect on weight of shoots and roots was noted. Results do not support the view that as regards these species intact plants grown from seed can benefit from addition of vitamin B₁ to an otherwise favourable nutrient medium. The findings may be considered as indicating that green plants under favourable propagation conditions from seed can synthesize adequate amounts of vitamin B₁, but they do not bear directly on the effect of this vitamin on the rooting of cuttings. The seed is a storage organ for vitamin B₁, the cutting is not. Cuttings of different species or the same species under different conditions may differ in vitamin B₁ content, which may in some cases become a limiting factor in root development. Thus the beneficial effect of this vitamin on the rooting of certain cuttings is not inconsistent with the finding that green plants propagated from seed can synthesize their vitamin B₁ requirements. When it is considered that vitamin B₁ is synthesized in higher plants in the green leaves under the influence of light it is interesting to note that the presence of leaves on cuttings usually promotes root formation. Whether under adverse conditions the same green plants grown from seed would respond favourably to vitamin B₁ remains uncertain.

1275. GAVRILOV, K. I. 577.15.04

On the dynamics of growth-substances of the group B (bios) in plants.

C.R. Acad. Sci. U.R.S.S., 1939, 22: 365-9, bibl. 9.

Trials are described on the content of bios substances at different times of day and year in leaves and flower buds of *Tilia cordata*, *Betula pubescens*, *Fraxinus excelsior*, *Syringa vulgaris* and *Ulmus effusa*.

* See also 1332, 1341, 1346, 1451, 1545.

1276. PARKER-RHODES, A. F. 577.15.04 : 631.4

Preliminary experiments on the estimation of traces of heteroauxin in soils.

J. agric. Sci., 1940, 30 : 654-71, bibl. 8.

A method is described for detecting and measuring small amounts of indolylacetic acid in the soil from the effect of this substance on osmotic pressure of root hair cells of wheat seedlings. Tests of the effect of different manurial treatment show that farmyard manure tends to increase the quantity present. The effect of sterilization of the soil was also examined and is discussed.

1277. VAN OVERBEEK, J. 577.15.04

Auxin in marine plants II.*

Bot. Gaz., 1940, 101 : 940-7, bibl. 12.

Auxin was found in practically all the marine plants analysed in the summer of 1939. They included many species of brown and red algae, two diatoms and several higher plants.

1278. CHOLODNY, N. G., AND GORBOVSKY, A. G. 577.15.04 : 612.014.44

Influence of β -indolyl-acetic acid upon photosynthesis.

C.R. Acad. Sci. U.R.S.S., 1939, 22 : 452-5, bibl. 2.

The authors worked with leaves of lilac, poplar, jasmine, hemp, hydrangea and other plants, and were led to the following conclusion:—Heteroauxin introduced in very weak solution (1 : 1,000) into the tissues of a green leaf causes a temporary increase in photosynthesis of 100-200%. When longer action of the solution is tested, the photosynthetic energy sometimes falls below the original level. Leaves immersed for several hours in a (1 : 100) β -indolylacetic acid solution showed little effect on intensity of assimilation. It is suggested that the increase in photosynthetic activity as the result of leaf injuries may perhaps be attributed to accumulation in the injured leaves of active substances (phytohormones) which act upon the process of assimilation in the same way as heteroauxin.

1279. KIRKPATRICK, H. 577.15.04

Effect of indolebutyric acid on the rooting response of evergreens.

Profess. Pap. Boyce Thompson Inst., 1940, 1 : 273-80, being reprinted from *Amer. Nurseryman*, 1940, 71 : 8 : 9-12.

In tests on the rooting of evergreen cuttings at the Boyce Thompson Institute a greenhouse was used, unheated June to September and heated the rest of the year. An air temperature ranging from 60° F. at night to 75° F. in the day gave optimum results in the rooting of evergreen cuttings. Temperatures below 60° tended to decrease the effectiveness of the growth substance. Treated cuttings, planted in cold frames, responded well in summer, but practically not at all in winter. The rooting medium found best was two-thirds sand, one-third German peat moss mixture. Paint shading proved useful. The moisture in the rooting medium was kept on the low side. Cuttings were planted on a slant to ensure a high humidity round the tops of the cuttings. Tables are given showing the success obtained from exposure for different lengths of time to different amounts of indolebutyric acid both in powder and solution form. One or other combination of treatment was helpful in nearly all cases. Cuttings of one or two genera, e.g. *Cedrus* and *Pinus*, resisted all attempts to root them, but the author predicts that they will fall into line once the optimum conditions for those particular genera under the particular local conditions are discovered.

1280. KINOSHITA, S., AND KASAHARA, Z. 577.15.04

The effect of growth promoting substance on root formation. [Japanese, German summary.]

Bot. Mag. Tokyo, 1939, 53 : 138-43, [summarized in German, *Jap. J. Bot.*, 1940, 10 : (47)].

There are two opposing theories, one that a growth promoting substance cannot achieve its stimulating effect without the intervention of a second factor and the other that the intervention of this factor is unnecessary. The authors' trials with *Roripa*, *Nasturtium aquaticum*, *Chrysanthemum* spp., and *Thea* have shown that the combined action of heteroauxin and vitamin B helps to a definite increase in root formation. Thanks to the use of these two substances root

* For I see *Plant Physiol.*, 1940, 15 : 291, *H.A.*, 10 : 456.

formation can be induced on parts where it does not normally occur. In chrysanthemum heteroauxin has a positive effect, but not vitamin B. In *Thea*, which is known to be difficult to root, vitamin B causes definite root formation. The authors come to the following conclusion: The second factor is necessary for root formation and can be replaced by vitamin B. Plants which are easily rooted would therefore appear to be amply provided with the factor in question. [From summary in *Jap. J. Bot.*]

1281. HOWARD, H. W. 577.15.04
Heteroauxin and the growth of meristems of *Brassica*.

Ann. Bot., Lond., 1940, 4: 589-93, bibl. 12.

Howard refutes his previous finding that a leaf initial had been converted into a root meristem by the action of heteroauxin. The problem of the two types of plant meristems is discussed.

1282. STEWART, W. S. 577.15.04
Effect of naphthalene acetic acid on mobile auxin in bean seedlings.

Bot. Gaz., 1940, 101: 881-9, bibl. 3.

Mobile auxin was quickly increased in the terminal bud, internode and hypocotyl of 7-day-old bean seedlings by the application of a 1-2 mm. band of 2% lanolin paste of naphthaleneacetic acid round the middle of the first internode. Its other effects on auxin content are noted.

1283. TANG, P. S., AND LOO, S. W. 577.15.04
Tests on after-effects of auxin seed treatment.

Amer. J. Bot., 1940, 27: 385-6.

Plants of white mustard from seed treated for 24 hours with aqueous solution of indole-3-acetic acid (1 mg., 10 mg. and 100 mg. per litre) showed quicker growth and earlier bloom by 3 to 7 days than plants from untreated seed.

1284. OLSON, R. A., AND DUBUY, H. G. 577.15.04
Factors influencing the protoplasmic streaming in the oat coleoptile.

Amer. J. Bot., 1940, 27: 392-401, bibl. 52.

DUBUY, H. G., AND OLSON, R. A. 577.15.04

The relation between respiration, protoplasmic streaming and auxin transport in the avena coleoptile, using a polarographic micro-respirometer.

Amer. J. Bot., 1940, 27: 401-13, bibl. 17.

BONNER, J. 577.15.04

Specificity of nicotinic acid as a growth factor for isolated pea roots.

Plant Physiol., 1940, 15: 553-7, bibl. 12.

ROBBINS, W. J. 577.15.04: 635.64

Response of excised tomato roots to β (-4-methylthiazolyl-5)-alanine.

Plant Physiol., 1940, 15: 547-52, bibl. 2.

GROSS, E. W. 577.15.04

The responses of shoots of [24-hour-old] mungo bean seedlings growing in solutions of 3-indole-acetic acid.

Amer. J. Bot., 1940, 27: 371-5, bibl. 15.

Chemical analysis.

1285. WALL, M. E. 581.192
Micro determination of some constituents of plant ash.

Plant Physiol., 1940, 15: 537-45, bibl. 11.

1. The preparation of plant samples for mineral analyses has been described. 2. Colorimetric determinations of phosphate, magnesium, potassium and sodium are presented together with data on the accuracy of the methods. 3. A micro volumetric determination of calcium is described and data on the accuracy of the method presented. [Author's summary.]

1286. ILJIN, W. S. 581.192: 545.83
Quantitative microanalysis of salts and organic acid in plants.

Bull. Ass. russe Rech. sci. Prague, 1939, 9: 48-90, being *Sect. Sci. nat. math.* 66.

Methods are described for the estimation of barium, calcium and some of the organic acids occurring in plants, the aim being to obtain reasonably accurate results while avoiding

complicated chemical procedure. The estimations may be carried out either on plant sap or on plant extracts. It is suggested that the tissue be killed by chloroform vapour before the plant sap is pressed out when it is claimed that the composition of the cell sap is scarcely altered. The use of various reagents for purifying the sap previous to analysis is described. When a plant extract is to be examined the author advises that fresh material be taken, or material killed previous to drying. The substances extracted by water and various acids from the plant and the effect of heat on an acidic extract are discussed. Lead acetate is used to precipitate the organic acids, but the use of hydrogen sulphide to decompose the lead salts, as advocated in the paper, appears unwise since Franzen and Helwert (1923) showed that in the apple a much higher percentage of the acids were lost on deleading with hydrogen sulphide than with sulphuric acid. Oxalic acid is determined as the calcium salt, tartaric acid by a number of methods including a colorimetric method. Citric acid is determined as pentabromoacetone which displaces iodine from sodium iodide. Some difficulty was encountered in centrifuging the pentabromoacetone as it tends to float or stick to the glass walls of the centrifuge tube. It may be noted that a similar method described by Pucher, Vickery and Wakeman (1934) avoids this difficulty since the pentabromoacetone was extracted by means of petroleum ether. Finally the separation of malic acid from a mixture of citric, oxalic acid, etc., is described, together with a method for its estimation. The rather numerous typographical errors and the lack of a bibliography are to be regretted.

J.K.E.

1287. ÔNO, S.

547.458.88

Chemical studies on pectic acid.*Bull. School Agric. Taihoku* 1, 1940, pp. 1-39, bibl. 48.

The author deals with his subject in this technical article under the following headings:—(1) Introduction. (2) Preparation of pectin and its properties. (3) Preparation of pectic acids and their properties. (4) Mineral salts of pectic acid. (5) Methylation of pectic acid. (6) Pectic acid contents of fruits. (7) Hydrolysis of pectin and pectic acid with dilute mineral acids.

1288. KERTESZ, Z. I.

547.458.88

Criticism of a recent paper on the pectic content of plant materials.*Plant Physiol.*, 1940, 15 : 565-6.

The paper criticized is that by Elwell and Dehn, *Ibidem*, 1939, 14 : 809 ; *H.A.*, 10 : 32. It is suggested that the authors either overlooked an important detail in the chemical methods used or that some mistake was made in calculating the results, and that the figures given are either incorrect or do not represent "pectin".

1289. HEINZE, P. H., AND MURNEEK, A. E.

581.192

Comparative accuracy and efficiency in determination of carbohydrates in plant material.*Res. Bull. Mo. agric. Exp. Stat.* 314, 1940, pp. 23, bibl. 21.

Investigations on the comparative efficiency, accuracy and reliability of five popular methods of sugar determination in plant extracts show that Bertrand's method is the most accurate, if it is assumed that all true sugars are thus determined, but that the Shaffer-Somogyi method is nearly equally accurate and is more efficient and convenient. Other methods considered were those of Shaffer-Hartmann, Hagedorn and Jensen and Willaman and Davison. A procedure used successfully for the determination of carbohydrates in plant material by the Shaffer-Somogyi method is given in detail.

1290. MCHARGUE, J. S., HODGKINS, W. S., AND OFFUTT, E. B. 581.192 : 546.27

The boron content of some important forage crops, vegetables, fruits and nuts.*J. Amer. Soc. Agron.*, 1940, 32 : 622-6, bibl. 4.

The boron contents of a large number of food materials are tabulated. They include potatoes, tomatoes, and other root and green vegetables, a number of dried fruits, namely apricots, dates, figs, peaches, prunes, raisins, orange pulp, juice and seeds, and nuts such as hickory, pecan, hazel, walnut and peanut.

*Hydroponics.**

1291. RUSSELL, J. 663.61 : 581.084.1
Farming without soil.
Nature, 1940, **146** : 448-9, bibl. 6.

An interesting brief review by the Director of Rothamsted of the hopes offered by commercial water culture in this country. It seems unlikely that some of the fantastic claims made for the process, e.g. that it will be possible to grow enough wheat on an area the size of, say, Euston Station, to satisfy national requirements, will be put to the test. It may be noted that the Department of the University of California to which Gericke, the sober originator of the method, belongs, issued a statement with the purpose of damping irresponsible promises of this nature, promises which must have been extremely embarrassing to Gericke himself. It would appear, however, that many of the difficulties apparent on a small laboratory scale do not appear to cause so much trouble in large scale operations. Thus Gericke only has one basic formula for all his crops, the salts need not be pure, no special precautions are taken in mixing them and neither aeration nor growth of micro-organisms in the solution caused trouble. Further the solutions do not, as might be imagined, need constant changing. Sir John Russell notes Gericke's suggestions with regard to seed bed and basins containing the culture solution. He notes that the problem of root aeration is overcome by restricting the depth of the basin to 6 inches and allowing enough space between the surface of the solution and the crown of the root to ensure air movement. Gericke warns us that the safety margin in water culture is much narrower than in soil and that each crop needs special attention with regard to its needs in water culture. The correct moisture and temperature of the seed bed are particularly important. Gericke claims that the crops produced are of high quality and full value, "thus ranging himself against those who regard humus as necessary for healthy crop production" [Russell]. Results so far reported from England suggest that the desired equilibrium of solution may not be so easily attained here as under the clear and sunny skies of California. The results of single tests are :— (1) from Cheshunt that tomatoes grown thus gave a smaller crop than usual, while cucumbers gave considerably above the average soil-grown crop; (2) from Reading that the yields of tomatoes were as good as from soil, while gladioli yielded better; and (3) from Jealott's Hill that yields were inferior to those from soil. For amateurs a Penguin Special S63 [price 6d., any bookseller] gives valuable information.

1292. PROCOPIO, M. 663.61 : 581.084.1
 Teoria e pratica delle colture in soluzione nutritiva. (**Theory and practice of hydroponics.**)
Ital. agric., 1940, **77** : 358-65.

Includes illustrations of water culture apparatus in use at the Conegliano research station.

General.

1293. STOUT, A. B. 582
The nomenclature of cultivated plants.
Amer. J. Bot., 1940, **27** : 339-47, bibl. 14.

The author discusses the many rules laid down at different times with regard to the naming of plants, including those approved in 1939 by the International Committee for Horticultural Nomenclature. He criticizes them and offers suggestions of his own.

1294. DALDY, Y. 613.2 : 635.1/7
Optimum food values from the garden.
Gdnrs' Chron., 1940, **108** : 103.

An account of the improvement in health and stamina and the greatly decreased susceptibility to such ailments as colds, influenza and dental caries obtained in the case of Grammar School boys in Auckland, N.Z., who were fed on vegetables grown on naturally manured soil (i.e. farmyard manure, humus) as opposed to those fed from the produce of the soils treated with the usual chemical fertilizers. The experiment is being continued officially by the N.Z. Health Department.

* See also 1544.

1295. ORCHARD, E. R. 631.875

Compost : its preparation and use.

Sci. Bull. S. Afr. Dep. Agric. 201, 1939, pp. 28, bibl. 19, being *Chemistry Series* 157.

The author deals with practical methods of preparing compost under the following headings :— growth requirements of fungi and bacteria ; conditions favouring the preservation of green matter as silage, i.e. conditions to avoid in making compost ; the Adco process ; the Indore system ; other methods of making compost [chiefly that suggested by Timson in Rhodesia] ; the nitrogen balance sheet ; the manurial value of compost ; crop response to compost ; composting from the economic aspect.

1296. AYLEN, D., AND OTHERS. 631.459

Soil and water conservation. Part IV. Prevention and control of gullies.

Bull. S. Rhodesia Minist. Agric. 1155, 1940, pp. 21, being reprinted from *Rhodesia agric. J.*, 1940, 37 : 330-49.

Very useful notes with diagrams and photographs are given showing the necessity for and the best methods of preventing and remedying gullies under S. Rhodesian conditions.

1297. SWINGLE, C. F. 631.535/541 + 577.15.04

Regeneration and vegetative propagation.

Bot. Rev., 1940, 6 : 301-55, bibl. 287.

The author ably reviews the enormous amount of literature on vegetative propagation and indicates, so far as is possible, many implications of the results of research work in this field. He deals with the subject under four headings. *Investigations on regeneration not involving application of growth substances.* Practical experiments have been particularly concerned with the question of rootstocks for fruit trees, coffee, rubber and cacao. *Investigations on regeneration involving application of growth substances.* Reactions of intact or isolated plant parts to growth substances are almost without exception reactions to stimulus. The application of growth substances is a very important factor in determining rate and degree of regenerative phenomena, but they have very little, if any, qualitative effect on the regenerate. They incite the cambium to growth and division but its differentiation into vessels, fibres, etc., is conditional on other factors. Fruit formation is actually shown to be the non-specific response of the ovary to indoleacetic or other auxins which are usually, but not exclusively, an accompaniment of sexual reproduction. The use of growth substance with both hard and soft wood stem cuttings has been very successful, but not with root cuttings. They would appear also to have a place in stimulating new root growth following transplanting and perhaps in helping the operations of budding and grafting. *Regeneration among the lower plants.* Physiological studies with the lower plants have generally run parallel to those with the higher plants. *Leaf cuttings.* The decisive factor in bringing about regenerative phenomena in leaf cuttings appears to be the breaking of communication between growing point and leaf.

1298. PHILLIS, E., AND MASON, T. G. 631.542.44 : 633.51

The effect of ringing and of transpiration on mineral uptake.

Ann. Bot., Lond., 1940, 4 : 645-50, bibl. 10.

[In these experiments with cotton] 1. Removal of a ring of bark between the foliage region and the root was found to depress the uptake of bromine by the root within a period of a little over two hours from the time of ringing. 2. The wood alone in the ringed plants transmitted as much bromine up the stem as the bark and wood together in the normal plants. 3. Increased transpiration caused increased uptake of bromine in ringed plants, and a greater proportion of the absorbed bromine was carried into the aerial parts of the plant under high transpiration than under low. 4. It is presumed that transpiration affects mineral uptake by altering the concentration in the absorbing region of the root and possibly also by oxygenating the root, while assimilation affects uptake by altering the solvent capacity of the root. [Authors' summary.]

1299. DEMIDENKO, T. T., AND KISELEVA, V. V. 581.144.2

Trimming and regeneration of roots in cultivated plants.

C.R. Acad. Sci. U.R.S.S., 1939, 25 : 436-9, bibl. 5.

Sand and water culture studies with sunflower and Indian corn plants, conducted by the Institute of oil crops at Krasnodar.

1300. MALCOLM, J., AND SWAN, C. J. 631.3.083/084
The farm tractor, its construction, care and operation.
Bull. West Scot. agric. Coll. **135**, 1940, pp. 16.

An illustrated instructive account of the mechanism and method of testing the petrol-started, paraffin-running, four-wheeled farm tractor.

1301. FINLAY, R. H. 674.048
Timber preservation : butt treatment.
Bull. S. Rhodesia Minist. Agric. **1159**, 1940, pp. 14, bibl. 4, being reprinted from *Rhodesia agric. J.*, 1940, **37**: 448-60.

Preservatives used include creosote—very much the best if obtainable—, arsenious oxide, sodium arsenite, zinc chloride and others. Notes are given on impregnation by heating in solution for 3 hours at 180°-210° F. and cooling for 20 hours through 100° F. The amount of solution to be absorbed should be if possible at least 10 lb. or 1 gallon per cubic foot. Butt treatment by impregnation is often sufficient.

1302. NIKOLAEV, N. F. 631.524 : 635 + 633.5
The introduction of food and industrial plants into White Russia during 1935-8. [Russian.]
Ann. White Russ. agric. Inst. Gorki, 1938, No. 8 (30), pp. 79-87.

Of the fibres in addition to flax and hemp, already grown in White Russia, promising results were obtained with *Sida Napaea* Cav., *Althaea armeniaca* Tenore, *Kitaibelia vitifolia* Willd., ramie (*Urtica cannabina* L. and *Urtica angustifolia* Ledb.). In the case of the tender ramie cultivation appears to present great difficulty on account of severe climatic conditions. The trials with food plants are confined to *Ipomoea Batatas* Poir, *Cyperus esculentus* L. and haricot beans. So far no difficulties have been encountered. Of 70 ornamentals thriving under local climatic conditions some of the more decorative are named. Among these are *Actinidia arguta* Planch and *Vitis amurensis* Rupr.

1303. WADLEIGH, C. H., AND THARP, W. H. 631.544 : 581.084 : 519
Factorial design in plant nutrition experiments in the greenhouse.
Bull. Ark. agric. Exp. Stat. **401**, 1940, pp. 66, bibl. 10.

It is explained that it is advantageous to include all factors of an experiment simultaneously in order to obtain knowledge of the interactions between them. With the complicated experiments resulting "it is the experience of the writers in their plant nutrition work that it is far more essential to avoid errors of manipulation than to eliminate a rather dubious deficiency in the attainment of a theoretically ideal design". Four examples follow showing how it is possible to plan desirably comprehensive experiments that shall still be reasonably easy to carry out.

In Experiment A three cotton varieties, Cook 307, Rowden 2088 and Half and Half, were grown in sand culture in groups of three pots across a bench, each group of pots receiving one of twelve nutrient solutions according to its position along the bench. The advantage of systematically arranging the treatments was the elimination of error in the frequent addition of solutions, while the statistical disadvantage was largely overcome by the use of split-plot analyses. The group of three pots was the unit plot for the application of potash, two such groups for the application of one of the two levels of phosphate, and four such groups for one of three levels of nitrogen, the whole having four replicates. The variate measured was the incidence of fusarium wilt. Half and Half appeared to behave differently from the other two varieties so the last analysis was divided into two parts, one for the comparison of Cook and Rowden and the other for the deviation of Half and Half from the mean of the others. In order to obtain more information about interactions involving varieties the whole was analysed again with the data expressed as percentages of the appropriate variety mean.

Experiment B was intended to investigate the effect on fusarium wilt of nitrogen supplied at two levels from two sources at three acidities. There were the same three varieties and four replications with recordings after 31, 40 and 49 days. Again the treatments were arranged systematically and analysis was carried out by split-plot technique for each occasion separately. The

data illustrated the difficulties of choosing the best time for taking measurements when the varieties were not increasing in disease equally. Examination of the variances within varieties showed that Half and Half was different in variability after 31 days, less so after 40 and homogeneous after 49, a difficulty that was overcome by analysing first the difference between Cook and Rowden, and then the difference between Half and Half and the mean of the other two varieties. Also analyses of covariance were worked out for Half and Half correcting the figures for 49 days by those for 31, and correcting the figures for 40 days by the mean of the other two. The most interesting analysis of this experiment, however, is the last, in which all data are analysed together, each effect being divided into components having one degree of freedom, each of which was compared with its own interaction with blocks by way of error. Obviously the heterogeneity of the combined error caused no disturbance of this analysis. Experiments C and D are included to illustrate confounding of greenhouse experiments. The whole paper shows clearly that no worker in this field need be deterred from using complex experiments either by difficulties of manipulation or by lack of statistical methods of interpretation. S.C.P.

1304. YATES, F. 519 : 581.084.2
Modern experimental design and its function in plant selection.
Emp. J. exp. Agric., 1940, 8 : 223-30, bibl. 10.
 VASILIEV, V. N. 581.9
Komarov's study of the Far-Eastern flora and vegetation. [Russian.]
Sovetsk. Bot., 1939, No. 8, pp. 24-36, bibl. 111.
 A large list of papers by Komarov.
 CRANE, M. B. 576.1
The origin and behaviour of cultivated plants.
 Reprinted from *The New Systematics*, Oxford, 1940, pp. 529-47, bibl. 34.
 The plants concerned are fruits, flowers or vegetables.
 ARTSIKHOVSKY, V. M. 581.11
Measuring transpiration by increased weight of colloidal films. [Russian.]
Sovetsk. Bot., 1939, No. 2, pp. 39-49.
 VAN VLACK, C. H., AND CLAPP, L. E. 631.543
Contour farming for soil and water conservation.
Bull. Iowa agric. Exp. Stat. P11, 1940, pp. 323-35.

TREE FRUITS, DECIDUOUS.

General.

1305. VAN WYK, S. P., AND HAVEMANN, A. R. 634.1/8 : 633.8
An economic study of deciduous fruit farming in the Western Cape Province 1933/34 to 1935/36.
Sci. Bull. S. Afr. Dep. Agric. 183, 1939, pp. 47, being *Stellenbosch Series* 31.
 The first part of this study was published as *Sci. Bull.* 144. In the present bulletin the authors consider in detail the financial organization of a large number of fruit farms in the Stellenbosch, Ceres and Elgin districts and comment on their findings. Farms were largest in the Elgin area, average 129 morgen* and smallest in Ceres, average 98 morgen. Over-capitalization occurs in Stellenbosch with financially bad results. This can largely be attributed to the comparatively high residential value of farms in the area. Among other points established is the fact that labour is the most important single item of expenditure in all areas averaging 44% of total expenses in Stellenbosch, 37% in Ceres and 38% in Elgin. The second most important item is packing material, 14%, 25% and 16% respectively. It is found that the lower the percentage of the gross income per farm spent on labour, the more favourable were the financial results obtained in all three areas.

* 1 morgen = .63 acres.

1306. CLARK, J. A., AND WARREN, G. C. 634.1/2-2.111
Varieties of tree fruits for Prince Edward Island.
Publ. Canada Dep. Agric. **706**, 1940, pp. 11, being *Fmrs' Bull.* **97**.

In course of trying to check the rapid decline in fruit growing which has been apparent in Prince Edward Island since 1910 this annotated list is published of fruits commonly grown there with notes on their suitability. The fruits discussed are apples, pears, plums and cherries and the essential basic character is winter hardiness.

1307. THOMAS, P. H. 634.23
Cherry culture.
Tasm. J. Agric., 1940, **11**: 99-102, 136-44, bibl. 2.

In this practical article the following points may be of interest. The mazzard would appear to be preferable to mahaleb as a rootstock under Tasmanian conditions. Cherries on mahaleb are generally more dwarfed and come into fruiting earlier. The Kentish stock sometimes used is unreliable, the trees being dwarfed and comparatively short lived. The necessity for cross pollination is stressed and hence the inadvisability of confining plantings to only one or two varieties. For packing the New South Wales case, 26 in. \times 5 in. \times 6 in., or $13\frac{3}{4}$ in. \times $5\frac{1}{10}$ in. \times 4 in. is noted with approval. For dessert varieties handpacking and facing are adopted. The method of doing this is described.

1308. LESLEY, J. W. 634.25
Five new peach varieties especially adapted to mild winters.
Bull. Calif. agric. Exp. Stat. **632**, 1939, pp. 19, bibl. 7.

Partial or total crop failure often occurs in peaches grown under conditions suitable for subtropical fruits, as the result of prolonged dormancy due to lack of sufficient chilling in the winter. The chilling generally necessary is considered to be about 2 months' exposure to temperatures between 32° and 48° F. Such failures occurred 9 out of 15 years in California between 1924 and 1938. Breeding work was started by Babcock at Whittier, Calif., in 1907 and aimed at better fruit characters combined with adaptation to warm winters. After work in connexion with the Citrus Experiment Station at Riverside first the Babcock peach was evolved and later, after further work in which seedlings from the earlier work were used as well as several varieties collected by the Division of Plant Exploration, from 1,000 seedlings which had now borne fruit 5 were selected as promising for commercial planting on a small scale. Descriptions of these 5 are given. They are Rosy, Golden State, Ramona, Hermosa, and Sunglow.

Breeding and selection.

1309. FILOSOFOVA, T. P., AND ENIKEEV, KH. K. 634.22-1.521
The uses in selection of Mitchurin's blackthorn and *Prunus domestica* hybrids. [Russian.]
Sovetsk. Bot., 1939, No. 2, pp. 29-38, bibl. 11.

Cytological investigations were conducted at the Mitchurin Central Genetic Laboratory for Tree and Small Fruits. Among the more practical conclusions (under Russian conditions) were the following:—1. It is thought that by crossing local strains of blackthorn with a wide range of cultivated plums hybrids may be obtained hardier and more productive than the Mitchurin varieties, Desertny and Sladky. 2. Even better results are expected from back-crossing Mitchurin's hybrids, particularly the Ternovy Reine Claude, with the better plum varieties.

1310. POTAPENKO, J. 634.23-1.547.5
Acceleration of development and fruiting of fruit tree seedlings.
C.R. Acad. Sci. U.R.S.S., 1939, **23**: 839-42, bibl. 8.

The author has based his attempts to accelerate fruiting in fruit tree seedlings on the theory that the plants must essentially go through a certain number of cycles of development which normally take a year each before fruiting. The acceleration of the accomplishment of these cycles offers a method of advancing the fruiting stage. The author gives the following account of one of his experiments:—On 17 February, 1937, seeds of the cherry variety Ideal were sown

in a box in the hot house. Seedlings appeared at the end of February. They were pricked off into pots on 3 April. From mid-April till the first autumn frosts they were grown out of doors. They were then divided into two series of 39 plants each, as uniform as possible. One lot was left in the open. The other was treated with low temperature $+1$ and $+6^{\circ}\text{C}$. and on 27 December the plants were pricked off into pots 31 cm. high and 31 cm. across at the top. They were then transferred to the hothouse to pass their second growing season. In April 1938 the controls were transplanted to similar pots to undergo their second growing season in the open until autumn frosts. The hothouse seedlings had completed growth by 1 April, 1938, and on 19 April they were brought into a cold room with temperature ranging between $+3$ and $+5^{\circ}\text{C}$. On 29 June they were put out and on 1 July began their third growing season. Since in July the days shorten the seedlings were given weak electric light in the night, on the average 50 candle power per square metre, from 1 July to 30 September. In the second half of October their leaves assumed autumn tints and many fell—at a time when leaf fall was also taking place in the controls. From the second half of October for 2-2½ months the test seedlings were submitted to a low temperature phase of $+1$ and $+6^{\circ}\text{C}$. They were then transferred to the hothouse for their fourth growing stage. They started into growth in January, 1939, and 10 of them (25.6%) produced flowers. Thus at the time when the controls were starting their third growing season the accelerated seedlings had completed their fourth, which ended in flowering. Not a single flower was produced by the controls in their third season. This induced fruiting is not just a question of growth, as seedlings of vigorous growth in the open were certainly no more ready to fruit than the smaller ones. Potting moreover is of little importance, since the controls grown in pots of equal size did not form fruit bud primordia. The crucial point in accelerating development and fruiting is to make plants pass more quickly through the necessary cycles during which their internal condition is repeatedly changing as the result of interaction with their environment.

*Propagation.**

1311. TAKAGI, I. 634.38-1.531.16

On the storage of mulberry seeds. [Japanese, English summary.]

Res. Bull. Tokyo imp. sericult. Coll. 2, 1939, pp. 1-22, [summarized in English,

Jap. J. Bot., 1940, 10 : (66)].

Out of 20 methods tested for the storage of mulberry seeds, that in which they were kept in a desiccator over $\text{CaCl}_2 + 20\% \text{H}_2\text{O}$ or 43.8% H_2SO_4 proved best. Kept thus the seeds remained viable for 14 years as against 4 months in the controls. Whereas, moreover, 90% germination was obtained with the controls for only 1 month after cropping, in seeds over $\text{CaCl}_2 + 20\% \text{H}_2\text{O}$ 90% was obtained for 7 years. The water content of the control seeds was 7-10% as against 4.1-4.2% over the reagents. The relative humidity in the desiccator using 43.8% H_2SO_4 was 48. It is therefore concluded that mulberry seeds with a water content of nearly 4% will retain their vitality longest in an atmosphere of 48% relative humidity. [From summary in *Jap. J. Bot.*]

1312. SIEGLER, E. A., AND BOWMAN, J. J. 634.11-1.541.11 : 581.144.2

Root responses of noninfectious hairy root apple seedlings under different methods of propagation.

J. agric. Res., 1940, 60 : 739-54, bibl. 35.

The term "noninfectious hairy root" is applied to the condition in apple trees, particularly in 1-year-old seedlings, of excessive lateral rooting in the region extending from the collar to a distance several inches below the ground line. The trials here described were made on the seedlings of a large number of North American varieties and of French crab with (1) root cuttings from which plants were propagated directly, (2) grafts made from piece cuttings, (3) 1-year-old seedlings, and (4) seed from various sources in steamed soil in the greenhouse or in non-treated soil in the field. Scions from 1-year-old seedlings were grafted to the proximal portions of their own roots, root cuttings were made from the affected portions of these same seedlings and also from regions that appeared normal. A year after planting observations showed that:—

* See also 1297.

(1) On the grafts scion rooting occurred in all cases and the symptoms on the original root piece were suppressed. (2) On the 1-year-old seedlings (layered) stem rooting occurred in nearly all cases and the symptoms on the original pieces were suppressed. (3) On the plants grown from root cuttings which had shown symptoms on planting no stem rooting occurred and the symptoms on the original root piece were intensified. On the plants grown from root cuttings from symptomless regions of affected seedlings symptoms appeared. The American nurseryman who wants to avoid even non-infectious hairy root with its superficial likeness to crown gall or infectious hairy root should use no part of affected seedlings for the purpose. Although it is not assumed that all clones exhibiting symptoms will cause dwarfing, it is suggested that selection from clones exhibiting the more pronounced symptoms would appear likely to furnish a source of dwarfing rootstock.

1313. COOPER, T. P. 634.11-1.541.11
The first season's growth of apple grafts as affected by type of stock and part of scion.

Circ. Ky agric. Exp. Stat. **49**, 1938, pp. 11, bibl. 12.

Using comparable material of scion wood from known apple varieties and French crab seedlings as rootstocks it was found that the mortality was considerably greater when grafting was done on piece roots than on branched whole rootstocks. There was no difference in results from the use of tip-half or basal-half of the scion. There was no significant difference in either height or diameter of trees according to whether the scion tip or basal half was used or whether grafting was done on piece roots or branched whole rootstocks.

Rootstocks.

1314. BRADFORD, F. C., AND JOLEY, LL. 634.11-1.541.11
Causes and effects of size differences in apple trees in the nursery.
Tech. Bull. Mich. agric. Exp. Stat. **163**, 1939, pp. 54, bibl. 100.

After an interesting discussion on early literature dealing with stocks for apple trees, including the origin and use of the term Paradise stock, the authors consider a number of causes of size differences in apple trees. The following notes are from their summary. Seed of diploids such as Jonathan, McIntosh, etc., appears to produce seedlings whose performance in the nursery is equal to that of seedlings from the usual commercial sources [French crab, etc.—Ed.]. Seed from small apples produced seedlings as vigorous as those from seed of large apples. Individual differences noted in the seedling year were maintained in the second year, also in the budded whip and for the first two years in the orchard irrespective of whether the seedlings were budded to vigorous or rather weak-growing varieties. Varietal, seasonal growth patterns, i.e. period of maximum growth and time of cessation of growth were not affected by the size of the seedling on which the whip was budded, but the amount of growth made was closely related to the size of the seedling. Trees budded on the smaller seedlings of diploids grew rather better than those budded on seedlings of triploids, but their growth was more like that of the latter than that of trees on the larger seedlings of diploids.

1315. SPINKS, G. T. 634.11-1.541.11
Trials of clonal apple rootstocks selected from "free" and "crab" seedlings.
I. Performance at Long Ashton when worked with five scion varieties.
J. Pomol., 1940, **18**: 226-38, bibl. 3.

In trials at Long Ashton 15 clonal apple rootstocks originally obtained from free and crab seedlings were worked with Worcester Pearmain, James Grieve, Lane's Prince Albert, Newton Wonder and Blenheim Orange and the growth of the trees was compared with those on Malling II and XII. Trees on XII were the largest, followed by G8. Those on E7, E8 and G7 were similar in size to those on II. F11 had a more dwarfing effect. Incompatibility was encountered in A10 and D1. It is thought that stocks E8, F11 and G7 may be of value as semi-dwarfing stocks. G8 may be useful as a fairly strong stock which does not delay bearing so long as XII. E7 might also be recommended as a semi-dwarfing stock, were it not for its poor nursery qualities.

1316. HOBLYN, T. 634.11-1.541.11
Trials of clonal apple rootstocks selected from "free" and "crab" seedlings.
II. Performance at East Malling when worked with Lane's Prince Albert.
J. Pomol., 1940, 18 : 239-48, bibl. 6.

The performance over 14 years at East Malling of Lane's Prince Albert worked on 13 clonal rootstocks is compared with similar trees on 6 East Malling vigorous clonal selections and on commercial seedling crab stocks. A wide range of vigour was shown, though all were less vigorous than most of the Malling selections and two, A10 and D1 [as at Long Ashton, see previous abstract] were partially incompatible. Malling XII, C and A are outstandingly more vigorous than any of these seedling rootstocks. G7 and F11 give promise as heavy cropping, moderately vigorous and semi-dwarfing rootstocks respectively. [E8 similarly recommended at Long Ashton was not tried.] E7 would also be in this category were it not for its poor nursery qualities shown both here and at Long Ashton. This poor nursery quality also prevents the recommendation of Crabs A and C mentioned above.

1317. RAO, Y. V., AND BERRY, W. E. 634.11-1.541.11 : 581.192
The carbohydrate relations of a single scion variety grafted on Malling rootstocks IX and XIII. A contribution to the physiology of dwarfing.
J. Pomol., 1940, 18 : 193-225, bibl. 35.

A study is described of the seasonal and regional distribution of carbohydrates in the current season's growth of scions of Crawley Beauty apple on Malling stocks IX and XIII at Long Ashton. 2. Concentration of reducing sugars, disaccharides and starch were higher in the bark and wood of the scions on IX than in those of scions on XIII. 3. Carbohydrate concentrations were higher in the bark than in the wood of both stocks and scions. 4. The seasonal variation in the carbohydrate fractions in the scion on IX differed from that in the scion on XIII. 5. The gradients of disaccharides and starch in the scion differed on the different stocks. 6. Seasonal variation of the carbohydrate fractions in scion and stock coincide fairly closely on XIII, but not on IX. 7. The concentration of disaccharide in the bark of IX attains a minimum value two weeks earlier than in the bark of XIII. 8. Starch accumulation begins several weeks earlier in IX than in XIII. 9. Starch accumulation in bark and wood of scion begins a fortnight earlier on IX than on XIII. 10. As regards longitudinal distribution of the carbohydrate fractions in the stem, there is no indication of interference with downward movement of sugars at the graft union. 11. Starch accumulation in both stocks precedes growth cessation in the respective scions, but cessation of extension growth in the scions is accompanied by a simultaneous increase in the starch content of the scion wood. 12. The water content of IX and its scion is less than that of XIII and its scion. 13. It is concluded that the early and extensive accumulation of starch in IX may be the immediate cause of the dwarfing effect of IX and the early cessation of growth in the scion. 14. A possible explanation is offered for the dwarfing influence of IX. [From authors' summary.]

1318. SHPON'KO, G. A., AND OZEROV, G. V. 634.11-1.541.11
The effect of apple rootstocks on growth of fruit trees. [Russian.]
Sovetsk. Bot., 1939, Nos. 6-7, pp. 206-17, bibl. 13.

Trials conducted in White Russia have led to the following conclusions:—1. Antonovka stocks are recommended for Antonovka, Streifling and Serinka apple varieties. These rootstocks are hardy, vigorous, highly compatible and give excellent nursery material with well-developed root systems. 2. Litovsky Pippin was also found to be a highly satisfactory rootstock. This variety on its own roots was less susceptible to sun-scald injury to which it is rather susceptible on other stocks. 3. Serinka was a more suitable rootstock for Wealthy than for Antonovka. It was highly compatible with most varieties. 4. Nursery material on Titovka was healthy and vigorous. Compatibility was fair. However, Streifling on Titovka stocks was inferior to that on crab. 6. Borovinka cannot be recommended as a stock for Antonovka, the latter being more vigorous and healthy on its own stock or on crab. The experiments are being continued.

Root growth.

1319. SCHMID, F. A. F., AND NUTMAN, F. J. 581.144.2 : 631.536
A convenient method for the excavation of growing trees in undisturbed soil.
Soil Sci., 1940, 49 : 411-7.

The authors describe a method, whereby blocks of undisturbed soil of any reasonable size can be excavated and removed intact. The method has been successfully used with coffee trees with a mass of soil weighing about 2 tons. The only limiting factor would appear to be the capacity of the vehicle of transport and perhaps type of soil. In East Africa its success was achieved in very light friable soil with very few stones. The presence of many stones might make the method impossible. Clear diagrams and illustrations accompany the description.

Pollination.

1320. OPPENHEIMER, C. 581.162.3 : 634.1/2
Pollination studies with deciduous fruit trees. [Hebrew.]
Hassadeh, 1940, Vol. 20, Nos. 4, 5 and 6.

Pollination studies were carried out in Palestine with plum varieties in 1934/35, and with apple and pear varieties in 1935/39 in the interior valleys and were begun in 1939 in the hill district. The investigations will be continued, but for practical reasons certain preliminary results have been published. They may be summarized as follows:—1. The so-called Japanese plum varieties (i.e. diploid types mostly derived from *P. salicina* and *P. Simonii*) behaved as they were found to do in California and for that reason the investigation was discontinued after two years. Self-sterility is very pronounced in all but three varieties, namely Santa Rosa, Beauty and Climax. The variety Kelsey is not satisfactory as a pollinator. Very early flowering hexaploid plums can pollinate the diploid types successfully. Hexaploid, i.e. *domestica* plums are not grown to any extent in Palestine and were therefore not investigated. 2. Only one apple variety—Rome Beauty—and no pear variety is found to be self-fertile. 3. A number of apple and pear varieties show different degrees of self-fruitfulness. This ranges from the production of none, e.g. Delicious, or few parthenocarpic fruits to 100% fruitfulness, e.g. Canada Reinette. 4. There seems to be a relationship between climate and parthenocarpic fruit set. This relationship, which shows itself in differences between different localities and also between different years at any one place, is not yet fully proved. Investigations on the subject will be carried out and details of these should be available later. 5. Data on germination of apple pollen agree with those from Europe, but pear pollen germinates very badly at high temperatures. Under artificially constant conditions germination was 70% at 19-22° C. and 24% at 28-30° C. This low germination, however, does not impair the efficacy of cross-pollination. In certain cases emasculation seemed to act as a stimulant to parthenocarpy but with all but one pear variety differences in set seem to be mere chance fluctuations. [C.O., author.]

Growth and nutrition.

1321. SMITH, W. H. 634.11 : 581.471
The histological structure of the flesh of the apple in relation to growth and senescence.
J. Pomol., 1940, 18 : 249-60, bibl. 7.

Within one and the same variety of apple, a correlation was found between the average size of cell in the flesh and the weight of the mature fruit. The larger apples had the larger cells. They also had a larger number of cells than smaller apples of the same variety. Fruit-size at maturity was thus found to be determined both by the amount of cell-multiplication and by the degree of cell-enlargement. Either factor might be dominant in determining fruit-size. Apples of different varieties were found to vary widely in cellular structure. While the average size of cell was related to the length of the season of growth, the average size of fruit for the variety was largely determined by the amount of cell-multiplication. In general, early maturing varieties also had more cells per apple than late varieties. Varieties of apple which mature early and have a short season of growth were found to have a larger number of cells per unit weight of tissue, and this characteristic was associated with high respiration rate and poor

keeping quality. Later-maturing varieties having a long season of growth were found to have a smaller number of cells per unit weight, associated with low respiration rate and good keeping quality. [Author's summary.]

1322. BALLENEGGER, R. 634.1/7-1.8
Gyümölcsfák egy éves hajtásainak nitrogén-, foszfor- és kálitartalma. (**The N, P and K content of 1-year-old shoots of fruit trees.**) [French summary.]
Bull. roy. Hungarian hort. Coll., 1940, 1 (n.s.) : 9-10.

The N, P and K content of the one-year-old shoots of different genera and even of different species of fruit tree growing in the same soil varies greatly. That of one and the same species varies in relation to the soil content of those minerals where the tree is growing. These results are confirmatory *Ibidem*, 1939, 5 : 9-16 ; *H.A.*, 10 : 504.

Soils, manures and orchard practice.

1323. PAUL, M. 634.1/7-1.543
La plantacion de frutales por el sistema de filas en curvas a igual nivel o por contorneamiento. (**A plea for contour planting of fruit trees.**)
Circ. Estac. exp. agric. Tucuman 78, 1939, pp. 8.

Notes on contour layout with due regard for irrigation, the object being to avoid erosion.

1324. CUMMINGS, M. B., AND DUNNING, R. G. 634.11-1.536
A study in recovery of transplanted apple trees.
Bull. Vt agric. Exp. Stat. 432, 1938, pp. 24, bibl. 12.

Bearing apple trees of McIntosh, Delicious and other well known varieties not more than 14 years old were transplanted and the effect was noted. The hardiest varieties withstood transplanting best. Transplanting adversely affected growth, foliage and cropping for at least three years. Hints for the success of transplanting include the following :—A compact root system can be developed by cutting off some of the longer roots a year before transplanting. Good soil packed firmly next to the roots helps. Transplanting should take place in early spring or early autumn under Vermont conditions. Cool, moist or overcast days should be chosen to prevent drying out of roots. Soil basins to catch and retain water are better than mounding to keep the soil moist. The first few weeks after transplanting are all-important. The soil into which the roots are transplanted should be above the average. Mechanical injuries should be avoided or properly treated on occurrence.

1325. COLLISON, R. C. 634.11-1.874
Experiments in orchard soil management : fertilizers, mulches and cover crops.
Bull. N.Y. St. agric. Exp. Stat. 691, 1940, pp. 37.

Three years' results from deep placement of fertilizers in a McIntosh apple orchard show no advantage of this system over ordinary broadcasting on the surface. The importance of suiting nitrogen dressings to amount and composition of mulches is stressed. In a McIntosh orchard on medium light soil a surface-mulch of marsh hay and straw, reaching from the trunk to beyond the branches, apparently supplied so much nitrogen that the addition of the amount of sulphate of ammonia normally recommended for non-mulched trees (5 to 6 lb. per tree) proved excessive, and resulted in poor fruit colour and increased fruit drop. Mulches of straw and of peat were found to decay with almost equal rapidity. A study in varietal response to different fertilizer treatments shows that Delicious has appreciably more calcium in its leaves than Baldwin, McIntosh and Spy, and this may be related to the suspected susceptibility of Delicious to acid soil conditions. Cover crop studies included alfalfa, alsike clover, bluegrass (*Poa pratensis*), buckwheat, Kent white clover, ladino clover, millet, oats, rye, soybeans, Sudan grass (*Sorghum sudanense*), sweet clover, rape, red clover, vetches, and weeds. These were grown on open plots, so tree shading and competition are not considered ; but the point is made that the best time to build up the organic matter of a plantation is when it is young and trees and cover crops will not compete severely. Figures for snow retention and some weights of cover crops are given, but most of the information is in the form of general observations. All the crops had good and bad points, and no definite recommendations are made. On the whole, permanent

or semi-permanent covers appeared more satisfactory than annual cover crops under New York conditions. It is hoped to discuss the relations of the various crops to nitrogen and humus stores in the soil in a later report. W.S.R.

1326. **BALLENEGGER, R.** 634.25-1.432.2
 Adatok az őszibarack termőhelyének ismertetéséhez (5). VII. Nedves-
 ségmérések. . . . (Peach tree ecology. The water content of a clay soil
 in 1939.) [French summary.]

Bull. roy. Hungarian hort. Coll., 1940, 1 (n.s.) : 3-8.

A further year's observations serve to confirm the author's previous findings, *Ibidem* various, H.A., 10 : 505. In winter there was adequate water throughout the orchard tending to excess in the lower parts of it. From the beginning of summer the water content fell, especially in the first 180 cm., the amount of decrease varying with the method of cultivation. The fall was much less in soil kept cultivated than in that under grass. Rains in the hot season had very little effect on soil moisture content. In the clean cultivated area the variation in moisture content throughout the year was extremely small.

1327. **WALLACE, T., AND SPINKS, G. T.** 634.11-1.8
 A long period field experiment on the manuring of apple trees.
J. Pomol., 1940, 18 : 182-92, bibl. 2.

Observations are made on a manurial experiment carried out with Edward VII and Allington apple varieties on Malling I stocks since 1920 at Long Ashton. From 1924 to 1935 the main object was to compare the result of different times of application of a complete fertilizer. After 1935, the effects of withholding the manure from half the previously manured area were noted. In the first period, growth, blossoming and fruiting were all significantly affected by the position of tree, the manuring and time of manuring, but not the form of manure, i.e. whether organic or inorganic. Applications in March were best and in June the least effective. August applications were intermediate in effect. The biennial habit in Allington was not effected by any treatment. As regards storage the percentage rots were greater in the manured than in the unmanured plots, whereas core flush and other physiological symptoms were more prevalent in the heavy cropping years in the unmanured plots, possibly due to potash deficiency. In the second period, 1936-39, the absence of manuring resulted in decreased vigour, evident especially in foliage quality, but also in reduced blossoming and crop. Comparative storage quality was not appreciably affected but it is noticeable that in a plot unmanured since 1924 the percentage total breakdown was very high, i.e. 63% in the 1938 crop. This is possibly the result of withholding potash for so long.

1328. **TALBERT, T. J.** 634.11-1.542
 Results of some young apple tree pruning experiments.
Res. Bull. Mo. agric. Exp. Stat. 313, 1940, pp. 22, bibl. 11.

Trial and observation in Missouri indicate that although cutting back of young apple trees at planting or during the first three years of growth may ordinarily not be justified, such treatment after trunk injuries due to rabbits, hail, etc., may be entirely satisfactory. It did not appear to affect the time of coming into bearing. As regards pruning the modified leader type of pruning dwarfs young trees slightly and delays bearing slightly in the early years, but produces a fairly low spreading tree with many well-placed lateral branches. At the profitable bearing age of 10-12 years it will produce ample, high-quality fruit. The open head type of pruning needs severe cutting and may thus delay profitable bearing for as long as 2 years. The yield may also be reduced in the early years of bearing. The mechanical framework of trees treated is, moreover, not so strong as in the modified leader trees. It does, however, have the advantage of accessibility.

1329. **EDGECOMBE, S. W.** 634.1/2-1.542
 Pruning fruit trees.
Bull. Iowa agric. Exp. Stat. P10, 1940, pp. 291-319, bibl. 5.

Fruitgrowers' practical bulletin on pruning deciduous fruit trees under Iowa conditions.

1330. PICKETT, B. S. 634.11-1.542
"Thin wood" pruning considered from the standpoint of photosynthate production.

Tech. Bull. Mich. agric. Exp. Stat. **169**, 1940, pp. 20, bibl. 15.

The thin wood pruning methods advocated by Ricks and Gaston appear to give uniformly successful results and the trials here described indicate the reason for this. Two years of experiments in the apple orchard directed to the determination of the comparable amounts of organic matter produced by "thin" wood leaves and "thick" wood leaves respectively show that under Michigan conditions thick wood leaves produce about three times as much organic matter as thin wood leaves. The fruit from thin wood branches is likely to be smaller and less highly coloured than that from stouter branches. The method advocated by Ricks and Gaston consists essentially in removing from the tree its comparatively slender bearing wood and leaving the thick or stocky bearing wood. It is no good trying to improve the growth of the thin wood by removing good fruiting wood from the outside of the tree.

1331. TUKEY, H. B., AND LEE, F. A. 634.25-1.542.24
Growth and development of the embryo and fruit of the peach as affected by ringing and defoliation of the branches.
Bot. Gaz., 1940, **101** : 818-38, bibl. 16.

The trials on the effects of ringing and defoliation reported here were made in 1936 and 1937 on Elberta and Ward Late peach varieties. The data supplement previous results which showed that it is abortion of the embryo which induces early ripening of the fruit and not the reverse by demonstrating that when the supply of materials to the embryo from outside the fruit is limited, i.e. as ringing and defoliation, the embryo continues to increase in size and storage materials continue to be mobilized. At the same time similar materials in the endosperm, nucellus, integuments, stony pericarp, fleshy pericarp and adjacent twigs either decrease in amount or are retarded in mobilization. [From authors' summary.]

1332. MURNEEK, A. E. 634.1/2 : 631.542.24 + 577.15.04
New practices to regulate the fruit crop.
Bull. Mo. agric. Exp. Stat. **416**, 1940, pp. 15.

The first practice described here is ringing or scoring at the time of full bloom. Experiments in Missouri show that it is nearly always beneficial to yield when carried out on branches of vigorous apple trees. The bark removed should be $\frac{1}{8}$ - $\frac{1}{4}$ in. wide and the wound should be covered with grafting wax. Scoring or knife edging may be as effective. This consists of cutting through the bark two or three times completely round the limb, the cuts being a few inches apart. Pears and the Royal Duke cherry have also been found to respond to ringing but neither peaches nor the Montmorency cherry, which is normally a heavy bearer, responded. After ringing, the fruit is generally not only more numerous but also larger and earlier ripening. The second practice described is that of spraying with naphthalene acetamide .001% solution, or naphthaleneacetic acid .001% solution to prevent preharvest drop of apples. The spray should be applied directly the dropping begins. If the period of dropping is much longer than 2 or 3 weeks a second application at half strength may be given. Spraying must be thorough. Finally fruit setting can be prevented in the "on" year of biennially bearing varieties by destroying the bloom in the late cluster bud stage with a caustic spray. Creosote oil at 1½% concentration was found best, but cresylic acid at 1½% strength and good tar oil at 3% strength are also highly effective.

1333. GREVE, E. W. 634.11-1.547.6
Sun-coloring apples in Delaware.
Trans. Peninsula hort. Soc. **1939**, 1940, pp. 112-6, bibl. 4.

Experiments in Delaware with McIntosh apples show that apples spread on straw beneath the north side of the tree and left for 8 days will gain tremendously in red colour. This exposure did not cause the fruit to soften enough for its market value to be affected, the only change being an increase in value due to the better red achieved.

1334. CAMPBELL, B. A., GOSSELIN, A., DOYLE, P. E., AND DELORME, N. 658.8 : 634/635

The marketing of fresh fruits and vegetables in the city of Montreal.

Mimeographed Rep. Dep. Agric. Canada, 1940, pp. 100.

This report is much on the same lines as those noticed in *H.A.*, 10 : 920 dealing with marketing of fruit and vegetables in Toronto and Ottawa. The information concerns the calendar year 1937. It deals with method of arrival, analysis of methods of marketing, e.g. by wholesale marketing agencies or other agents, marketing by growers themselves. Appendices contain figures of sources of vegetables and fruits entering the market from America and elsewhere.

1335. TALBERT, T. J. 634.1/7-1.543

Establishing the orchard.

Circ. Mo. agric. Exp. Stat. 202, 1939, pp. 23.

Practical advice for the deciduous tree fruit planter.

TINSLEY, J. 638.14

Hints and instructions to beginners in beekeeping.

Bull. West Scot. agric. Coll. 138, 1940, pp. 8.

JAMIESON, C. A. 638.14

Care of bees and equipment.

Publ. Canada Dep. Agric. 685, 1939, pp. 4, being Circ. 157.

SCHULTZ, E. F. 631.874 : 635.65

El caupi para abono verde o para rotacion con otras plantas cultivadas.

(Cowpea for green manuring or in rotation with other crops.)

Circ. Estac. exp. agric. Tucuman 82, 1939, pp. 7.

SMALL FRUITS, VINES AND NUTS.

1336. HUNT, E. M. 634.71

Growing raspberries for home use [in Minnesota].

Ext. Bull. Minn. agric. Ext. Div. 206, 1940, pp. 12.

The cultivation for home use in Minnesota of red and black raspberries and of blackberries is considered in some detail and a few notes are given on pest and disease control.

1337. BRIERLEY, W. G., AND WINTER, J. D. 633.711

Growing red raspberries for market [in Minnesota].

Ext. Bull. Minn. agric. Ext. Div. 199, 1939, pp. 16.

A growers' bulletin on red raspberries giving practical details of different systems of planting and training, pruning, soil management, including cover crops, picking, marketing and preservation by freezing.

1338. LEWIS, D. 634.711

Genetical studies in cultivated raspberries. II. Selective fertilization.

Genetics, 1940, 25 : 278-86.

The first paper in this series was published in *J. Genet.*, 1939, 38 : 367-79, noted only *H.A.*, 9 : 1187.

1339. SWARTWOUT, H. G. 634.72

Growing gooseberries and currants.

Circ. Mo. agric. Exp. Stat. 208, 1940, pp. 12.

Hints are given on growing gooseberries and currants in Missouri, i.e. the southern edge of their cultivation belt, where conditions are really too warm for optimum growth.

1340. LEDEBOER, M., AND RIETSEMA, I. 634.723 : 581.162.3

Unfruitfulness in black currants.

J. Pomol., 1940, 18 : 177-80.

Examination of the course of events after self-pollination of the Lees variety of black currant shows that the pollen tube actually grows the whole length of the style and reaches and enters the ovule, there lying against the embryo-sac nucleus. Then, however, the male and female

nuclei fail to fuse. It is suggested that the same occurs in other unfruitful rogue varieties. Excellent illustrations are given.

1341. CHANDLER, F. B., AND MASON, I. C. 577.15.04 : 634.73
The effect of growth substances on the rooting of blueberry cuttings.
Science, 1940, 92 : 35.

The authors' results with indole-3-acetic acid, indole-3-propionic acid, phenylacetic acid and Auxilin confirm those obtained by Johnson in Michigan [*H.A.*, 9 : 1188] and do not support the use of growth substances for the rooting of blueberry cuttings.

1342. EGGERT, R. L. 634.75
Methods of retarding the ripening of strawberries in Northern Michigan.
Quart. Bull. Mich. agric. Exp. Stat., 1940, 23 : 20-6.

The chief practical measures which tend to retard ripening in strawberries in Northern Michigan are found to be planting on a northern rather than southern slope, in clay rather than sandy soil and mulching with wheat straw in November. The use of the mulch retarded the beginning of the season some 3 or 4 days only, but the dates of the largest pickings and of the last pickings by some 7-10 days.

1343. ANTHONY, W. G. 634.75-1.8
Injury from spring application of fertilizers to strawberries.
Trans. Peninsula hort. Soc. 1939, 1940, pp. 133-6.
 SCHRADER, A. L. 634.75-1.8
Fertilizer applications and plant development of the strawberry, especially considering fall applications.
Trans. Peninsula hort. Soc. 1939, 1940, pp. 137-40, bibl. 2.

Preliminary fertilizer tests in the first or setting year indicated that wherever potash and/or nitrate of soda formed part of the fertilizer in the spring of the first year growth was checked. Experiments in Maryland show that the use of early autumn application of fertilizer on strawberry beds can be based with some assurance on its pronounced effects on crown and root developments, which in turn are directly correlated with better fruiting the following spring.

1344. SNYDER, E., AND HARMON, F. N. 634.8 : 581.145.2
"Synthetic" Zante currant grapes.
J. Hered., 1940, 31 : 315-8, bibl. 5.

The ordinary Zante currant vine can only be made to yield profitably by ringing. Other seedless types have originated by mutation and breeding and the hope is expressed that the breeder will some time obtain a currant-type seedless grape which will produce commercial crops without annual ringing.

1345. MORTENSEN, E., AND RANDOLPH, U. A. 634.8
Grape production in Texas.
Circ. Tex. agric. Exp. Stat. 89, 1940, pp. 26, bibl. 28.

Cultivation hints and notes are given on a large number of American and European vine varieties and their suitability for growing in Texas as table grapes or for wine.

1346. VIDAL, J. L. 577.15.04 : 634.8
 Nouveaux essais sur l'application d'hormones végétales au bouturage des vignes d'enracinement difficile. (**New attempts to root difficult vine cuttings with the aid of growth hormones.**)
Progr. agric. vitic., 1940, 113 : 429-31.

Neither in the present nor previous experiments has the author achieved outstanding success by the application of various supposed growth stimulants to cuttings of vines. A 5% solution of Hormodin proved more successful than Exuberose and cow urine, the period of immersion before planting being 4 days. Using Hormodin on 40 cuttings of Berlandieri Lafont No. 9 he obtained 70% rooting as against 50% rooting in untreated cuttings. Moreover the plants formed were exceptionally fine. This, however, was the peak of his achievement.

1347. EDGECOMBE, S. W., AND MANEY, T. J. 634.8-1.542
Grape training and pruning in Iowa.
Bull. Iowa agric. Exp. Stat. P7, 1940, pp. 227-39, bibl. 4.

The spur method of pruning proving unsatisfactory with the Concord grape experiment has shown that the Kniffin system is the best. This consists of one permanent trunk with four short lateral branches, more or less permanently fixed to wire trellis. This single-stem, 4-cane Kniffin system is described with illustrations.

1348. DIACHENKO, A. E. 634.51-1.53
Propagation of walnuts in U.S.S.R. [Russian.]
Sovetsk. Bot., 1939, No. 4, pp. 127-36, bibl. 16.

The best methods of propagating *Juglans mandschurica* Max. and *Juglans cinerea* L. in the colder regions of Russia are either sowing in autumn in permanent quarters or in the nursery, whence the seedlings must be transplanted at the age of one year. Vegetative propagation is difficult.

1349. SCHUSTER, C. E., AND STEPHENSON, R. E. 634.51-1.432
Soil moisture, root distribution and aeration as factors in nut production in Western Oregon.
Stat. Bull. Ore. agric. Exp. Stat. 372, 1940, pp. 32, bibl. 10.

Normal rainfall in Western Oregon is about 40 inches, but of this only 5.4 inches fall in the May to September period. Most of this summer rainfall consists of light showers which wet the surface and evaporate. A good soil depth of at least 5-6 feet of penetrable, aerated soil is necessary for successful walnut growing. The climate demands the adoption of dry-farm methods of moisture conservation or irrigation. Cover crops must be worked into the soil in the first half of April and the stored soil moisture conserved for tree growth. The distribution of walnut roots at different soil levels in different types of soil has been determined and is shown here.

1350. SMITH, C. L., AND ROMBERG, L. D. 634.521 : 581.162.3
Stigma receptivity and pollen shedding in some pecan varieties.
J. agric. Res., 1940, 60 : 551-64, bibl. 5.

In trials extending over 1-3 years a wide variation in the length of the periods of stigma receptivity was discovered both in different varieties of pecan in the same year and of the same variety in different years. The latter variation is attributed to variation in time of initiation of growth of buds producing pistillate shoots and to seasonal variations. Pecan varieties can be placed in two groups. In one pollen shedding occurs relatively early and stigma receptivity relatively late, in the other the position is reversed. The degree of dichogamy in different varieties was found to vary widely, in some allowing for a good set following self-pollination, in others not permitting this. No case of a pronounced shift in dichogamy in either direction was found in the course of the trials.

PLANT PROTECTION OF DECIDUOUS FRUITS.

1351. PIPER, C. S. 632.19 : 631.811.9
The symptoms and diagnosis of minor-element deficiencies in agricultural and horticultural crops.
I. Diagnostic methods. Boron. Manganese.
II. Copper. Zinc. Molybdenum.
Emp. J. exp. Agric., 1940, 8 : 85-100, bibl. 1-57, and 8 : 199-206, bibl. 58-83.

This paper is a review of the present knowledge of symptoms, diagnosis and results of deficiencies of some minor elements on agricultural and horticultural crops. *Boron deficiency.* In tobacco the symptoms are breakdown of the tissue at the base of the terminal bud leaves, or, less severely, a distortion in the shape of the young leaves. In cauliflower, discolouration of the central part, often hollow stem, and bitter flavour when raw or cooked. In celery, heart rot and cracked stem. The deficiency in apple shows itself in internal cork of the fruit (=drought spot or corky core), the vegetative parts of the tree remaining unaffected. Apricots are affected with brown spotting of the flesh either at the stem end in mild cases or over the whole length of the fruit in

more severe ones. *Manganese deficiency.* In cereals there is retardation of growth with streaks of collapsed tissue in the lower leaves. In mangold and sugar beet the symptoms are adequately described for the leaf in the term "speckled yellows". Sugar cane exhibits whitish chlorotic streaks on the leaf blades chiefly on the 3rd, 4th and 5th below the youngest unfolded leaf. Later, reddish spots occur on the streaks and may become continuous, causing longitudinal splitting of the leaves accompanied by stunted growth. In tomato there is retarded growth, failure to flower and a characteristic mottled chlorosis in the younger leaves followed by necrotic spots in the yellow areas farthest from the veins. Tobacco shows similar chlorosis, the terminal bud, though checked, does not die. In peas the disease known as marsh spot is possibly a manganese deficiency. With tree fruits little work has been done. Citrus exhibits a mottled chlorosis, as do almonds and other deciduous fruit trees on a manganese-deficient soil near Port Lincoln, South Australia. *Copper deficiency.* In fruits of many kinds the symptoms are known as exanthema. The terminal and subterminal branches, leaves and fruits are affected. Citrus has abnormally large dark green leaves, new branches make angular and distorted growth and multiple buds turning into bushy rosette growth are produced. There is a characteristic formation of gum pockets between bark and wood and the shoots turn yellow and die. The fruit acquires irregular gum-soaked areas causing hardening, cracking and dropping. In prunes copper deficiency restricts growth. Vigorous spring growth is produced but later the terminal buds wither and fall and the terminal leaves turn yellowish. There are eruptions on the bark and swollen and multiple buds. In plums, peaches and apricots there are interveinal bright yellow areas with serious rosetting and dieback. Symptoms in cereals are then discussed. Decreased seed production is the most important symptom in peas. Tomatoes and beet show interveinal yellowing with a curling upwards and inwards of the leaf edges. Copper deficiency symptoms differ with each kind of plant, but constant features are chlorophyll defects and necrosis of the leaves. *Zinc deficiency.* In peas the lower leaves progressively die off from the edges to the midrib. In potatoes the leaves become smaller, curl upwards at the edges and take on bronze coloured irregular spots which may in severe cases kill the leaves. In sugar beet greyish brown spots appear, the leaves wither from the top and only the midrib remains green. In Canada zinc deficiency symptoms have occurred on all ordinary varieties of orchard tree, usually in the form of little leaf or rosette. Fruit trees vary in degree of susceptibility to zinc deficiency in the soil. Sweet cherries suffer most while deficiency symptoms appear in descending order of severity in apple, plum, peach, walnut, apricot, citrus and grapevine. In tung oil trees zinc deficiency is indicated by bronzing of the foliage with the newly forming leaves becoming progressively smaller and deformed with necrotic spots and appearing bunched owing to the shortening of the internodes. *Molybdenum deficiency.* No naturally occurring disease has been traced to this deficiency but the essential nature of the element has been proved in growth solutions. Tomatoes deprived of it developed mottling distinct from any other deficiency symptom with necrosis at the leaf margin and a characteristic involution of the laminae. The flowers mostly dropped without setting. The need for traces of molybdenum has also been proved by the author for oats.

1352. WALLACE, T.

634.72-2.19-1.811.6

Magnesium deficiency of fruit trees : the comparative base status of the leaves of apple trees and of gooseberry and black currant bushes receiving various manurial treatments under conditions of magnesium deficiency.

J. Pomol., 1940, 18 : 261-74, bibl. 2.

1. The [chemical] base status of the leaves of apple trees, and of gooseberry and black currant bushes, growing on similar soils under conditions of magnesium deficiency and receiving several manurial treatments, has been examined. 2. Base status in the three cases showed fundamental differences, apart from the manurial treatments, due to differences in ash contents and the proportions of lime and potash in the ash. In particular, the gooseberries and black currants showed high ash contents and the apples a low ash content ; the apples and gooseberries contained fairly high proportions of both CaO and K₂O in the ash, whereas the black currants contained a preponderance of lime and a relatively low amount of potash. 3. The status of magnesium in the three kinds of fruit was similar, but in the gooseberries and black currants the levels were raised when potash was deficient or dung was applied. 4. The results, considered

in relation to the incidence of magnesium deficiency symptoms on the plots, suggest that the values 0.40% MgO and 20 milligram equivalents MgO per 100 gm. of dry matter may be regarded as approximate levels below which magnesium deficiency will occur for all three kinds of fruit. [Author's summary.]

1353. ASKEW, H. O., AND THOMSON, R. H. K. 634.11-2.19 : 546.27
Boron status of New Zealand apples.

N.Z. J. Sci. Tech., 1939, 21 : 128A-9A, being *Publ. Cawthron Inst.* 36.

Samples of apples from the Auckland, Hawke's Bay, Marlborough, Canterbury, and Central Otago districts have been analysed for boron content. All except those from the last district appear to show a satisfactory boron status. This is in keeping with the known freedom of internal-cork symptoms in the samples when received and from the generally accepted fact that internal cork is not known, commercially, in New Zealand outside parts of the Central Otago and Nelson districts. In Central Otago some of the samples showed low boron contents, although the fruit was free from internal cork; the boron content even in these samples was somewhat higher than that associated with internal-cork ailment found in the Nelson district and Central Otago. [From authors' summary.]

1354. SCHUSTER, C. E., AND STEPHENSON, R. E. 632.19 : 546.27
Sunflower as an indicator plant of boron deficiency in soils.
J. Amer. Soc. Agron., 1940, 32 : 607-21, bibl. 5.

The sunflower shows boron deficiency symptoms very clearly and since it can easily be grown under greenhouse conditions it has been adopted as an indicator plant in soils or nutritive solutions. If it does not show boron deficiency symptoms in a short time, one can be reasonably sure that enough boron is being supplied for its normal growth. If it does show symptoms the response of other plants should be studied. The symptoms in sunflower are cessation of growth of terminal bud, reduced dry weight and abnormal leaf characteristics. For boron deficiency symptoms to be quickly visible it is essential that adequate amounts of other basal nutrients should be present.

1355. HUSZ, B. 634.11-2.19 : 546.47
 Megfigyelések az almafa törpeszárúságáról. (**The rosette disease of apple trees in Hungary.**) [English summary.]
Bull. roy. Hungarian hort. Coll., 1940, 1 (n.s.) : 11-37, bibl. 39.

Rosette or little leaf symptoms have been noted in apple trees growing in black alkali soil under somewhat arid conditions in Hungary. Spraying with zinc sulphate from April to June gave promising results as also the injection of zinc salts, the best results having been obtained in an orchard where both stable and artificial manures had previously been used. There would appear to be a serious lack of available zinc in these soils.

1356. HIBBARD, P. L. 631.416.8 : 546.47
The chemical status of zinc in the soil with methods of analysis.
Hilgardia, 1940, 13 : 1 : 1-29, bibl. 11.

The original purpose of the study described here, namely, to devise a method of determining by laboratory test whether additional zinc is needed to produce healthy plants on a given soil, has been only partially accomplished. Actual trial with plants will generally be necessary. The laboratory methods actually tried are described and criticized. A study of the distribution of zinc in the soil shows that there is a much larger concentration on the smaller than on the larger particles of soil, so that clay soils are usually better supplied with zinc than sandy soils. Probably much, if not all, the easily soluble zinc in ordinary soils exists there mainly on the surfaces of particles where it is held by surface attraction and not in true chemical combination.

1357. BERNON, G. 634.8-2.19
 La coulure de la vigne. (**Coulure in vines.**)
Progr. agric. vitic., 1940, 113 : 465-8.

A brief account of the main reasons for coulure in the vine and methods of prevention. Coulure consists in the abnormal fall of flowers at the moment of opening or of the berries just as they

become visible. Its causes include malformation of flower and sex organs, inefficiency of pollen, excessively vigorous vegetative growth with resulting starvation of the developing fruit. An average temperature of 17° or 18° C. is necessary for proper flowering. If this is not forthcoming the flowers do not open properly and fruit setting does not take place. If plant nutrients are insufficient, the effects will be seen first in faulty flowering and fruit set, the roots, stalks and foliage having first call on plant food. Cultural operations affect set. Thus ploughing tends to cool the soil surface by release of humidity and so lower the temperature for the plant. As regards pollination, however, sulphuring helps by scattering the pollen. Coulture varies with latitude and altitude, being more frequent under the cooler conditions of northern Europe than in North Africa. It is also a varietal character. Its incidence varies also with rootstocks, those inducing great vigour more often showing coulture in their scions than less vigorous stocks. Remedies suggested are grafting on suitable stocks, tip thinning of shoots whose growth absorbs nutrients which would otherwise ensure proper setting, and ringing just below the bunch. Both tip thinning and ringing must be done at the beginning of flowering. Other causes of premature berry fall are fungi and pests and each has its special remedies.

1358. WALTERS, D. V., AND LUDBROOK, W. V.

634.8-2.19

"Dying vines" in the Murray Valley.

J. Coun. sci. industr. Res. Aust., 1940, 13: 183-6.

A few irrigated vines die each year in the Murray Valley showing the following symptoms:—The dying begins in the dormant season and is first noticeable when the vines fail to produce new growth in the spring. If the stem of an affected vine is split open a brown area with a characteristic sour odour is found in the wood at the base of the stem. It usually appears to originate from a tillage injury. Fungi found in these areas do not appear to be the cause and young vines planted to replace affected vines have made normal growth. The trouble would appear to be primarily physiological.

1359. PROTSENKO, D. F.

634.1/2-2.111: 581.145

The effect of low temperatures on bursting buds and on flowers of some fruits and soft fruits. [Russian.]

Sovetsk. Bot., 1939, No. 1, pp. 61-8, bibl. 12.

The effect of low temperatures, obtained by artificial freezing, was studied at the Ukrainian research institute for fruit and berries on buds and flowers of various fruits. The results may be summed up as follows:—1. Low temperature injury to buds, flowers and small fruits is closely related to the stage of their development. 2. The critical temperature at which injury occurs varies to a certain extent with sorts and varieties, depending not only on temperature but also on length of exposure. 3. Bursting buds are completely destroyed when subjected for 6 hours to -8° C. 4. Exposing bursting buds to -4° C. for 4 hours caused no injury. 5. The injury to flowers was but slight when they were held at -2° C. for 24 hours. At -4° C. many flowers were completely destroyed. The number of dead flowers varied with variety. The percentage of deaths was higher at longer exposures. 6. A complete destruction of flowers of all fruit varieties tested was observed at -6° C. for 4 hours or at -8° C. for 2 hours. 7. The effect of low temperature on bursting flowers of pome fruits was negligible at -2° C. for 2 hours. Even at 4 hours' exposure the number of flowers destroyed did not exceed 10%. 8. The critical temperature, resulting in wholesale destruction of flowers of pome and stone fruits lies within -3° C. and -4° C. Exposing the flowers for 4 hours to -4° C. gave a 94% kill in plum, 92% in pear and 85% in apple. 9. Pistils and peduncles proved to be the most sensitive parts of the flower. Staminal threads and anthers were less so. The petals were appreciably more sensitive than the sepals. 10. Pollen viability was poorer as a result of low temperature and depended on the length of exposure and air humidity, the effect of low temperature on pollen growth first becoming evident at -4° C., and full non-viability occurring at -6° C. 11. The injury of some small fruitlets of most varieties of fruits occurred at -2° C. for 4 hours. 12. Death of all small fruitlets occurred in pears at -3° C. for 4 hours and in all other fruits at the same temperature after appreciably longer exposure. All fruitlets of apples, pears, cherries and plums were destroyed when exposed to -4° C. for only 2 hours.

1360. ANDERSON, P. O. 632.183

Planting the standard windbreak.

Ext. Bull. Minn. agric. Ext. Div. 196, 1939, pp. 15.

A very practical bulletin for the Minnesota farmer who wants to beautify his homestead and afford himself protection from snow drifts.

1361. DICKER, G. H. L. 634.711-2.753-2.8

On *Rubus* aphides and leaf hoppers as possible vectors of raspberry mosaic.

J. Pomol., 1940, 18 : 275-86, bibl. 12.

So far no species has been conclusively proved to transmit raspberry mosaic in Great Britain. A mosaic transmission experiment at East Malling with Lloyd George raspberries using *Macrosiphum rubiellum*, *M. rubifolium*, *Amphorophora rubi*, *Aphis idaei* and leaf hoppers gave inconclusive results in 1938-9. It has, however, now been shown that Lloyd George being a symptomless carrier is not a suitable variety for such tests and in consequence an indicator variety, Baumforth B, has now been grafted to the doubtful Lloyd George plants and the result is awaited with interest.

1362. MOZNETTE, G. F., AND OTHERS. 634.52-2.6/7 + 2.3/4

Insects and diseases of the pecan and their control.

Fmrs' Bull. U.S. Dep. Agric. 1829,* 1940, pp. 70.

With the development of pecan growing into a specialized industry in the southern United States the problem of insect control has become much more important. In this bulletin the findings are given of continuous investigations into the cause and cure of the more important pests and diseases. The worst insects are considered to be pecan nut case-bearer (*Acrobasis caryae* Grote), the hickory shuck worm (*Laspeyresia caryana* Fitch) and the black pecan aphid (*Melanocallis caryaefoliae* Davis) and the most destructive diseases scab (*Cladosporium effusum* Wint. Demaree) and the nutritional disease rosette.

1363. WORMALD, H. 632.42 + 632.48

Host plants of the brown rot fungi in Britain.

Trans. Brit. mycol. Soc., 1940, 24 : 20-8, bibl. 13.

Of the two brown rot fungi found in Britain *Sclerotinia laxa* (*Monilia cinerea*) is the cause of blossom wilt of fruit trees and ornamental shrubs of species of *Pyrus* and *Prunus*, while *Sclerotinia fructigena* (*Monilia fructigena*) is the fungus most frequently found associated with fruit brown rot. Observations of the occurrence of *M. cinerea* on core fruits, and of *M. fructigena* on stone fruits are described. The fungi have been found on a number of species of ornamental shrubs. Cross-inoculations with the fungi from various hosts have yielded positive results on a number of other hosts. [Author's summary.]

1364. BRIEN, R. M. 588.427 : 632.48

Brown-spot (*Alternaria Passiflorae* Simmonds). A disease of the passion vine in N. Zealand.

Plant Diseases Div. Bull. N. Zealand D.S.I.R. 37, 1940, being reprinted from *N.Z. J. Sci. Tech.*, 1940, 21 : 275A-9A, bibl. 5.

Characteristic symptoms of this brown spot of passion vine are brown circular spots on leaves and depressed brown lesions on fruits and stems. When severe the disease leads to defoliation, fruit shrivelling, reduction of carrying capacity and of crop. Remedies suggested are pruning out and destruction of infected material, pruning and training of vines to allow of spray penetration and periodic spraying with bordeaux 3-4-50. [From author's summary.]

1365. TEMPLE, C. E. 634.75-2.411

Red stele root rot of strawberry.

Trans. Peninsula hort. Soc. 1939, 1940, pp. 141-9.

Recent investigations show that the red stele root rot of strawberry is the same as Lanarkshire or red core disease caused by a species of *Phytophthora*. It is now said to be spreading rapidly

* Superseding *Fmrs' Bulls.* 1654 and 1672.

in the U.S. Inspection and certification of nurseries should prevent further spread in the Delmarva Peninsula. At the same time the breeders have found it fairly simple to produce highly resistant varieties by crossing. Work at Beltsville, Md, has already produced some 5,000 hybrid strawberry clones, at least one parent of each of which is resistant or immune. From these it is hoped to produce some varieties as good as present ones with the added advantage of immunity to red stele.

1366. STEER, W. 631.654.3

Migration of the red spider.

Gdnrs' Chron., 1940, 108 : 28-9.

A brief account of the observations which led to the discovery that adult females of the red spider mite of fruit trees (*Oligonychus ulmi*) were able to migrate from tree to tree somewhat in the manner of young garden spiders by floating on strands of gossamer. The red spider mites hang from the leaves on these threads which are broken by the smallest current, whereupon the mites drift away to fresh pastures. These migrations are carried out by large numbers and may be responsible for the reappearance of red spider in late June and July on trees that have been sprayed clean at petal fall. Lime-sulphur sprays at $\frac{3}{4}\%$ present practically the only method of combating these invasions without leaf injury and are also useful against scab. With sulphur-shy varieties derris or similar rotenone-containing wash may be used. Summer oil emulsion is effective against all stages including eggs but cannot be used with safety in all districts.

1367. HESS, A. D. 632.76 : 634.11

The biology and control of the round-headed apple tree borer, *Saperda candida* Fabricius.

Bull. N.Y. St. agric. Exp. Stat. 688, 1940, pp. 93, bibl. 30.

Recommendations for the control of this beetle pest of apple trees, *Saperda candida*, include the following :—The eradication of wild host plants from the vicinity. The application of sprays of lead arsenate or cryolite to the foliage of young orchards in June and early July. For infested trees the use of an injection gun containing dichlorethyl ether, pyrethrum extract in alcohol, rotenone extracts and a solution of paradichlorobenzene in carbon disulphide is recommended. Clean culture will facilitate control.

1368. WOOD, M. 634.11-2.76 : 635.937.34

The rose leaf beetle in Pennsylvania.

Bull. Pa agric. Exp. Stat. 387, 1940, pp. 22, bibl. 57.

To control damage by the rose leaf beetle, *Nodonota puncticollis* Say, to apples it is recommended that trees should be sprayed just before the time the beetles are known to attack, i.e. in late May or early June in Adams County, Pa, using 3 lb. lead arsenate per 100 galls. spray mixture. The life history and a description of the insect are given.

1369. PICKETT, A. D., AND NEARY, M. E. 632.77 : 634.1/7

Further studies on *Rhagoletis pomonella* Walsh.

Sci. Agric., 1940, 20 : 551-6, bibl. 8.

An examination of the hosts found to be acceptable for ovipositing by the different forms of *Rhagoletis* which normally develop in the fruits of apple, hawthorn, blueberry and snowberry (*Symphoricarpos racemosus* Michx.).

1370. ARMSTRONG, T. 632.78 : 634.25

The life history of the peach borer, *Synanthedon exitiosa* Say, in Ontario.

Sci. Agric., 1940, 20 : 557-65, bibl. 15.

Notes are given on investigations at Vineland Station, Ontario, and Grimsby since 1935 into the life history of the peach borer, a pest of the U.S.A., Canada and Argentina. Parasites have been reared from the cocoons and identified, but they appear to be of minor importance in checking the increase of the insect.

1371. HASEMAN, L. 634.51-2.78

The walnut caterpillar.

Bull. Mo. agric. Exp. Stat. 418, 1940, pp. 14.

The walnut caterpillar (*Datana integerrima* G. and R.) only occasionally becomes a serious pest of walnut, pecan and similar nut trees in Missouri. In such cases poison spray, arsenate of lead, at 1-2 lb. per 50 gallons of water or hand picking the caterpillar colonies should suffice.

1372. HASEMAN, L., AND BROWN, H. E. 632.78 : 634.1/2

Controlling the fruit-tree leaf roller (*Cacoecia argyrospila* Walk.).

Circ. Mo. agric. Exp. Stat. 203, 1939, pp. 4.

A dormant oil spray including 6% of oil in the emulsion very thoroughly applied during dormancy in early spring should suffice to control the fruit tree leaf roller in Missouri. Where infestation is particularly heavy further spraying with lead arsenate 2-4 lbs. per 100 gallons in the late cluster bud stage and again just after petal fall may be necessary.

1373. HAYWARD, K. J. 632.961 : 634.1/7-2.77

Distribución de enemigos naturales de las moscas de las frutas para su control biológico. (Methods of distributing the natural enemy of the fruit fly for the purpose of its biologic control.)

Circ. Est. exp. Agric. Tucuman 79, 1940, pp. 5.

A short account of the method adopted by the Tucuman experiment station for the control of fruit flies. It consists in the distribution of cases containing fruit fly pupae parasitized by *Eucoila pelleranoi* and *Diachasmoides* spp. The fly on emergence is retained in the box by a wire mesh but the parasites can escape to continue the good work of parasitizing other fruit flies.

1374. MARTIN, H. 632.95

Efficiency with economy in the control of plant diseases and pests. I. The general problem and the transition to war conditions.

Ann. appl. Biol., 1940, 27 : 433-6.

MOORE, M. H. 632.952

II. Protective fungicides. [Summary.]

Ibidem, 1940, 27 : 436-7.

JARY, S. G. 632.951

III. Some entomological aspects of the problem. [Summary.]

Ibidem, 1940, 27 : 437-8.

DAVIES, C. 632.95

IV. Some factors determining the efficiency of spraying operations. [Summary.]

Ibidem, 1940, 27 : 439-40.

WOOLDRIDGE, A. J. 632.95 : 634.1/2

V. Some practical aspects of fruit spraying. [Summary.]

Ibidem, 1940, 27 : 440.

A useful symposium forming the [mainly] summarized proceedings of the Association of Applied Biologists 15 March, 1940.

1375. VINSON, C. G., AND MCCRORY, S. A. 632.951

Substitute spray materials. II.

Res. Bull. Mo. agric. Exp. Stat. 316, 1940, pp. 14.

In harmony with results reported in *Mo. Exp. Stat. Res. Bull.* 292 [*H.A.*, 9 : 498], nicotine-bentonite combination cover sprays, beginning after the calyx spray with lead arsenate, were fully as effective as lead arsenate in controlling codling moth and producing clean fruit. The percentage of stings in 1939 on fruit from plots sprayed with nicotine-bentonite combinations was very greatly reduced under the number of stings on fruit from the plot sprayed with lead arsenate. The addition of a spreader and sticker such as summer oil, whole milk powder, and Vatsol O.T. increased the effectiveness of the nicotine-bentonite combinations. The addition of Floor Seal did not make for increased effectiveness of the spray, although it did increase the deposit and retention of nicotine on the fruit and foliage. The dry-mix method of preparing

nicotine-bentonite preparations produced a product which gave no obvious and objectionable residue on the fruit. [Authors' summary.]

1376. BRAID, K. W. 632.51

The eradication of bracken.

Scot. J. Agric., 1940, 23 : 31-6.

The author discusses the features of various bracken cutters and breakers, and as regards the motor driven machines notes that the Collins Junior [see also *H.A.*, 10 : 1006] is probably the least easily damaged and the one most capable of covering the ground quickly. A strong advocate of cutting, he insists that, if carried out, the process should be completed. For the last few times of cutting a Collins "Mopper up" or a Crossley or Triangular Bracken Cutter behind an old car are recommended. Spraying and dusting methods he considers too expensive except for small areas. He believes that even when bracken is eradicated by cutting it will come back unless the acidity of the soil is reduced and the quality of the herbage grown to exclude it is improved. He gives figures of average composition of bracken rhizomes, perennial rye grass and potato tubers and suggests that it should not be beyond the scope of small local industries to put bracken rhizomes to some such use as the production of power alcohol and to convert the fibre into bracken board.

1377. PRUNSTER, R. W. 632.51

Notes on the control of blackberry, *Watsonia*, bracken and ragwort in Victoria.

J. Coun. sci. indust. Res. Aust., 1940, 13 : 178-80.

Exact instructions are given for the eradication of these tiresome weeds. The two essentials are first that the weeds must be weakened by cutting and burning as in the case of bracken or by ploughing and cultivating as in the case of blackberry and *Watsonia*, and secondly, that having thus checked them severely the immediate necessity is to occupy the land with useful plants, e.g. pasture plants. The pastures must then be generously treated by careful grazing and heavy top-dressing and by continuing to cut such a recurrent weed as bracken for a few months on reappearance.

1378. OTERO, I. I., AND COOK, M. T. 632.8 : 016

Third supplement to partial bibliography of virus diseases of plants.

J. Dep. Agric. Puerto Rico, 1938, 22 : 263-409.

COOK, M. T.

632.8 : 016

Second supplement to host index of virus diseases of plants.

J. Dep. Agric. Puerto Rico, 1938, 22 : 411-35.

COOK, M. T.

632.8 : 016

Second supplement to insect vectors of virus diseases of plants.

J. Dep. Agric. Puerto Rico, 1938, 22 : 437-47.

HAWAII, I.

634.38-2.8

On the intracellular bodies associated with the dwarf disease of mulberry trees.

Ann. Phyt. Soc. Japan, 1939, 9 : 17-21, [summarized in English, *Jap. J. Bot.*, 1940, 10 : (45)].

EIDE, C. J.

632.314 : 634.11

Fire blight of apples.

Ext. Fold. Minn. agric. Exp. Stat. 71, 1939, pp. 3.

WORTHLEY, H. N., AND STEINER, H. M.

632.654.2-632.753

Experimental spraying to control European red mite (*Paratetranychus pilosus* C. and F.) and rosy apple aphid (*Anuraphis roseus*) Baker in 1939.
Bull. Pa. agric. Exp. Stat. 390, 1940, pp. 10.

ALLEN, H. W., HOLLOWAY, J. K., AND HAEUSSLER, G. J. 632.78 : 632.96
Importation, rearing and colonization of parasites of the oriental fruit moth, *Grapholitha molesta*.

Circ. U.S. Dep. Agric. 561, 1940, pp. 61, bibl. 5, 10 cents.

- BEAULIEU, A. A. 632.78
Studies on the life history of the codling moth in south-western Quebec.
Sci. Agric., 1940, 20 : 624-31, bibl. 1.
- WEBB, J. E., AND ALDEN, C. H. 632.78 : 632.96
Biological control of the codling moth and the oriental fruit moth.
J. econ. Ent., 1940, 33 : 431-5.
- STEINER, L. F. 632.78
Codling moth flight habits and their influence on results of experiments.
J. econ. Ent., 1940, 33 : 436-40, bibl. 3.
- GINSBURG, J. M. 632.95
Replacing cresylic acid with tar oil in the delayed dormant spray on apple trees.
J. econ. Ent., 1940, 33 : 440-3, bibl. 3.
- CUTRIGHT, C. R. 632.753 : 634.11
Technique in control experiments with apple aphids.
J. econ. Ent., 1940, 33 : 443-5.
- COX, J. A. 632.753 : 634.11
Comstock's mealybug on apple and catalpa.
J. econ. Ent., 1940, 33 : 445-7, bibl. 3.
- HAMILTON, D. W. 632.77 : 634.23
Spray residue and substitutes for lead arsenate in control of cherry fruitflies.
J. econ. Ent., 1940, 33 : 447-51, bibl. 3.
- CHANDLER, S. C. 632.76 : 634.22
Control of plum curculio on peach in Illinois.
J. econ. Ent., 1940, 33 : 451-3.
- SNAPP, O. I. 632.76 : 634.22
Further studies of the plum curculio in the Georgia peach belt.
J. econ. Ent., 1940, 33 : 453-6, bibl. 2.
- FAHEY, J. E., AND RUSK, H. W. 632.951 : 634.11
Effect of fruit growth and weather on deposits of insecticides on apples in Southern Indiana.
J. econ. Ent., 1940, 33 : 505-11, bibl. 14.

VEGETABLE GROWING.

1379. LYSENKO, T. D. 633.491-1.531 and 635.64 : 631.541.11
Changing the nature of plant organisms. [Russian.]
Sovetsk. Agron., 1939, No. 12, pp. 33-7.

Several interesting examples are given of changes induced in potato plants. (1) Late sowing (6 July) of potatoes in South Russia resulted in increased weight of tubers and total yields, the reason being more favourable conditions at the time of tuber formation. (2) Small tubers obtained from late sowing produced on sowing twice as large a potato crop as large tubers from early sowing. (3) Late sowing for several years in succession improved the yielding capacity of seed potatoes with every year. (4) These seed potatoes from late sowing always produced higher crops—whether sown in South Russia or Central Russia and whether sown in spring or summer—than seed from early sown potatoes. Furthermore, some half dozen instances of changes in fruit character are reported in tomatoes grafted on stocks of different tomato varieties or on *Solanum dulcamara* or sweet Bulgarian pepper.

1380. COOPER, J. R., AND WATTS, V. M. 635.1/7 : 631.8
Manure experiments with vegetable crops in Arkansas.
Bull. Ark. agric. Exp. Stat. 392, 1940, pp. 40, bibl. 3.

Trials were made of the comparative effect of adding farmyard manure to complete the fertilizer applications on different sorts of vegetables, strawberries and melons on silt loam and fine sandy loam soils in Arkansas. On the silt loam strawberries, sweet potatoes, canning tomatoes and peppers did not respond profitably. Potatoes, snapbeans and onions made profitable returns for the manure when only the cost of handling was considered. Asparagus, spinach and cabbage

showed a profit with manure costing \$1 a ton. On the sandy loam no crop failed to pay the cost of handling the manure, and potatoes, tomatoes, watermelons, cucumbers, spinach and cantaloupes returned a profit with manure at \$1 a ton.

1381. LLOYD, J. W., AND MCCOLLUM, J. P. 631.8 : 635.25 + 635.34 + 635.63

Fertilizing onion sets, sweet corn, cabbage and cucumbers in a 4-year rotation.

Bull. Ill. agric. Exp. Stat. **464**, 1940, pp. 219-36.

Trials of different schemes of manuring for a four-year crop rotation lead to the suggestion of the following plan:—For cucumbers an 0N-8P-4K fertilizer; for onion sets a 4-8-4 fertilizer following a cover crop ploughed under in autumn; for sweet corn no fertilizer following a cover crop of rye and vetch ploughed under in early spring; for late cabbage following a cover crop of sweet clover a 4-12-4 fertilizer.

1382. ISAEV, S. I. 635.25 : 632.9

The onion miner, *Dizygomyza cepae* Her. [Russian.]

Ann. White Russ. agric. Inst. Gorki, 1939, No. 8 (30), pp. 105-17.

Distribution, morphology and biology of and damage caused by the onion miner are described. The control is limited to autumn cultivation by which the pupae are brought up on to the soil surface where they are subsequently killed by frost, rotation and interplanting.

1383. HAGIWARA, T., AND KUSAMITU, H. 635.31

Distinction of males and females in *Asparagus* by the use of potassium chlorate solution. [Japanese.]

Agric. Hortic., 1939, **11** : 990-2 [summarized in English, *Jap. J. Bot.*, 1940, **10** : (38).]

The authors' procedure was as follows:—Four shoots of asparagus cut off from male and female plants respectively were cultivated in tap water for 2 days, then inserted in 0.02% solution of potassium chlorate and put in a dark room for 1-2 days. They were then replaced in tap water and exposed to sunlight at the window for 2 days. The 4 male shoots were found to have deteriorated and their leaves fell at a touch. The female shoots, however, appeared unaltered and like the controls. The authors note that a similar greater resistance of the female plant to potassium chlorate is found in *Fragaria* and *Papaya*. [From summary in *Jap. J. Bot.*]

1384. HABER, E. S. 635.31

Effect of spacing and length of harvesting period on yields of asparagus.

Bull. Iowa agric. Exp. Stat. **P6**, 1940, pp. 212-24, bibl. 3.

The chief data yielded by 10 years' experiments with asparagus in Iowa are that:—(1) Cutting up to 15 July each year materially shortened the profitable life of the plant. (2) Cutting until 1st July for 10 years caused considerable reduction in yield after the sixth year and reduction in weight of spear. (3) Cutting until 15 June gave the greatest yields over the 10-year period. (4) Earlier cessation of cutting was not so profitable. (5) As regards spacing, plants spaced 1 foot apart in the row produced smaller spears than those spaced 2 and 3 feet. 2 or 3 foot spacing is satisfactory so far as average weight of spear is concerned. (6) Rows spaced 3 feet apart were satisfactory provided spacing in the rows was greater than 1 foot.

1385. MCGEORGE, W. T., WHARTON, M. F., AND FRAZIER, W. A. 635.52 : 631.8

Fertilization of lettuce on alkaline-calcareous soils : soil and plant studies.

Tech. Bull. Ariz. agric. Exp. Stat. **85**, 1940, pp. 399-451, bibl. 8.

Some 25,000 acres are devoted to lettuce cultivation in Arizona, the best season being from early September to mid-April. Most of the soils used are of the heavier alkaline-calcareous types. They are naturally deficient in organic matter, have high pH values, i.e. from 7.5 to 9.0, are well supplied with potassium but deficient in available nitrogen and phosphate. Among the conclusions reached in the 1934-6 experiments and confirmed in the 1938-9 season at a number of centres the following may be noted:—Soil analyses show that there is an initially heavy and continuous withdrawal of N, K and P from the soil by lettuce. There is a definite relation between the supply of available P and N in the soil, as determined chemically, and the quality and yield of good lettuce heads. Excellent response was made to the application of

nitrogenous and phosphatic materials. Phosphates accelerated and nitrogen delayed maturity. The best results were obtained with N and P mixtures in which part of the N was present in organic form. A profitable fertilizer response can be obtained from any method of application i.e. broadcast, drill, side dressing and band. A comparison of fertilizer efficiency in autumn and spring lettuce in one trial showed a greater recovery of both nitrogen and phosphate by the spring crop.

1386. BEVAN, W. H. C.

635.561

Watercress culture at Ewelme.

Gdnrs' Chron., 1940, 108 : 29.

An account of the methods of cultivating watercress at Ewelme. Here the beds are fed by chalk streams from the Chilterns. They are replanted annually, stock being raised from seed in nursery beds. The water is deflected and old beds cleared in June, the watercress being taken to local gardens and used, after stacking for a few months, as a source of humus. After a thorough cleaning the beds are replanted from late summer to November with rooted pieces from the nursery beds. After about 4 weeks the water is again allowed to flow through the whole planted area and except in very severe weather is kept at a depth of 5 inches. The first big heads are cut away to encourage the lateral growth. Damage may be done by flooding if severe enough to wash out the plants. Frost can also inflict damage and is countered by turning on a larger water supply and by placing the plants under water by means of a locally made "basher" [which is not explained—Ed.]. North-east and easterly winds will shrivel the crop which is here protected by windbreaks. The beds have also to be raked periodically to collect weed. The cutting, which starts in February, is done with a shoemaker's knife which is a convenient shape and having a wooden handle is non-sinkable. Cutting must be regularly carried out in order to maintain a supply of young shoots. The produce is packed into wicker flats made in Aylesbury holding 30-35 lb. The flats are stood on stools in the beds and filled direct without intermediate handling. The most useful variety is the medium leaf green cress because of its cropping powers and popularity; it also appears to be hardier than the brown cress. The latter is useful in isolated areas where the green cress does not thrive.

1387. GRIDIN, I. F.

635.624

Bare-seed pumpkin (*Cucurbita Pepo* L.).

Ann. White Russ. agric. Inst. Gorki, 1939, No. 8 (30), pp. 61-6.

In 1937 experiments were made at the Brilevo State farm (White Russia) with pumpkins of *Cucurbita Pepo* L. species, of which a characteristic is soft seed containing 49% oil. The fruit flesh and seed oil are used in human diet, and the seed cake in the condiment industry. The study includes the biology of growth and fruiting, agricultural methods, breeding for oil, productiveness, early ripening and immunity to diseases, and lastly spacing. The results are tabulated and may be summed up as follows:—The climatic and soil conditions permit sowing in the field. On formation of fruits on the leader and on the primary bines there is no need for secondary bines, the fruits of which take too long to ripen. Mounding up the bines with soil increases the plant's food reserves and resistance to wind. In order to obtain high seed yields the feeding area of the plant should be reduced to a minimum. Longitudinally shaped pumpkins contain more seed than round pumpkins. Provided manuring and care are adequate and varieties are suitably chosen, some 20,000 plants per ha. will produce approximately 5 tons seed.

1388. COCHRAN, H. L.

635.64

Improved methods of tomato production in Georgia.

Bull. Ga agric. Exp. Stat. 206, 1940, pp. 34, bibl. 1.

A well-illustrated manual for the Georgian tomato grower. Little is omitted from choice of varieties to marketing and storing. The tomatoes are grown in the open, being planted out immediately after all danger of late frost is over, the operation being carried out by a horse-drawn transplanting machine or by a hand-transplanter. Overhead irrigation, though expensive, is advocated. Four recognized types of pack for the fruit are described. Shipping tomatoes are generally harvested in the mature green stage and later ripened artificially with ethylene gas at a concentration of 1 cubic foot of gas to 5,000 cubic feet of room space at a temperature of 70° to 75° F. Notes are given on the chief pests and diseases and hints on their prevention or control.

1389. ANON. 635.64 : 581.143.26.03

Vernalization of tomatoes.

Gärners' Chron., 1939, 106 : 171.

A note is given on earlier results achieved by Turner and Burr of the University of Leeds and recorded *Ibidem* 1935, 98 : 288 and 1937, 101 : 10 by the application of vernalization treatment to tomatoes as well as on Goodall and Bolas' more recent work at Cheshunt (*A.R. exp. Res. Stat. Cheshunt* 1938 ; *H.A.*, 9 : 1287). The writer considers that there is a prospect of successful vernalization of tomatoes once the proper technique has been discovered.

1390. THOMAS, W., AND MACK, W. B. 635.64 : 631.8

Foliar diagnosis of differentially fertilized greenhouse tomatoes with and without manure.

J. agric. Res., 1940, 60 : 811-32, bibl. 9.

A detailed account with results graphically shown of the effect on tomato leaves, as revealed by chemical analysis, of varying the amount of nitrogen in the artificial fertilizer given with and without dressings of farmyard manure.

1391. HILL, H., AND ROACH, W. A. 581.111 : 632.19 : 635.1/7

Injection for the diagnosis of mineral deficiencies in the tomato, the potato and the broad bean.

Ann. Bot., Lond., 1940, 4 : 505-21, bibl. 5.

Diagnostic injection of vegetable leaves at East Malling is reported. A feature of the article are the very clear plates showing the results of particular injections. The authors summarize as follows:—1. A study was made of the distribution resulting from the injection of an aqueous solution of acid fuchsin into (a) an interveinal area of a leaf blade, (b) the leaf-tip, and (c) the leaf-stalk of the tomato, the potato, and the broad bean. 2. The plants were grown in sand culture deficient in one or more of the elements: nitrogen, phosphorus, potassium, calcium, magnesium, and boron, and were injected with solutions containing the deficient element. 3. The plants responded to all the elements injected. 4. The regions of the plants which responded to the nutrient injections were similar to those coloured by the dyes. 5. The response was local or general according to the injection method used. 6. The distribution of the injected liquids could be explained by the arrangement of the vascular system of the plants. 7. The methods described, (a) enable diagnosis of deficiencies to be made in 7-21 days, and (b) provide means of rapidly, and without injury, making good any deficiency to which the plant has been subjected.

1392. MARKOV, V. M., AND LALYKIN, N. S. 635.64 : 631.542

Pruning and training tomatoes in manure heated frames in Russia. [Russian.]

Trud. Timiriazev agric. Acad. Moscow, 1937, 2 : 3 : 134-51.

Comparative trials were made at the Otradnoye State farm of tomatoes pruned and trained (1) to a single stem (control), (2) to two stems, (3) three stems and (4) unpruned. Experiments, the object of which was to determine which of these forms gives the maximum early yields at the lowest cost, are described and results tabulated. The respective yields for the four sets were: (1) 64.14 tons per hectare, (2) 68.42 tons per hectare, (3) 74.17 tons per hectare and (4) 53.83 tons per hectare. Tomatoes trained to a single stem were found to be the most suitable form for cultivation in hothouses on account of early yield, comparatively cheap cost of production and greater resistance to diseases.

1393. KRONE, B. P.* 635.64 : 631.55

Harvesting tomatoes.

J. Dep. Agric. Vict., 1940, 38 : 60-8.

The operations of tomato culture in Victoria, Australia, now dealt with in this series are those involved in sizing, grading, packing and marketing. The essentials for success are summarized under the heading "Salient points for the packer". There is a chart for packing various sizes of tomatoes in long-bushel, half-dump and half-standard fruit cases.

* Articles by the same author on tomato culture in Victoria appeared *Ibidem* 37 : 64-7, 164-7, 271-4, 319-22.

1394. ELTINGE, E. T., AND REED, H. S. 635.64-2.19 : 546.47

The effect of zinc deficiency upon the root of *Lycopersicum esculentum*.

Amer. J. Bot., 1940, 27 : 331-5, bibl. 19.

An illustrated account of the malformations on tomato roots grown under several conditions, i.e. water culture, tissue culture of excised roots on agar slants, and growing root tips in hanging drops, zinc deficiency being a feature of all three.

1395. BERKELEY, G. H., AND KOCH, L. W. 633.71-2.3/4 + 2.19

Diseases of tobacco in Canada.

Publ. Canada Dep. Agric. 667, 1940, pp. 29, being *Fmrs' Bull.* 85.

Flue-cured tobacco was introduced into Canada about 1906. In 1938, some 95 million lb. tobacco valued at \$20,000,000 were produced on 83,000 acres. The areas concerned are two in Ontario, one in Quebec and a small area of flue-cured tobacco in British Columbia. The parasitic, climatic and physiological diseases so far encountered are here considered, recommendations on appropriate treatment being made. The symptoms of potash, nitrogen, phosphorus and magnesium deficiency are discussed.

1396. McLELLAND, C. K. 635.655

Methods and rates of planting soybeans.

Bull. Ark. agric. Exp. Stat. 390, 1940, pp. 18.

Three methods of planting were tried under Arkansas conditions, namely, planting in 3 foot rows and cultivating, drilling in seed rows 8 in. apart, and broadcasting followed by disc-harrowing. The varieties used were Mammoth Yellow and Laredo. The row cultivation proved greatly superior both as regards seed and hay return, especially in years of drought in the growing season. The rate of seeding proved relatively unimportant.

1397. GLASSCOCK, R. H., AND WAIN, R. L. 635.656 : 632.19

Distribution of manganese in the pea seed in relation to marsh spot.

J. agric. Sci., 1940, 30 : 132-40, bibl. 14.

The very strong indications that marsh spot is due to lack of manganese in the soil led to the authors' present investigation. They describe the symptoms of the disease and the methods of the analysis used by them for determining manganese in different parts of peas. They note where manganese occurs in diseased and healthy peas. Differences in manganese content of size groups suggest the necessity of selecting peas of uniform size for analyses when testing for relative manganese levels.

1398. HOERNER, G. R., AND RABAK, F. 633.79

Production of hops.

Fmrs' Bull. U.S. Dep. Agric. 1842, 1940, pp. 40.

Hops are grown in the U.S. in New York State, Oregon, Washington and California. An acreage of 40,000 fell to less than 20,000 during prohibition years but is now on the increase again. *Propagation*. This is mainly from root cuttings. *Varieties*. The chief varieties used are Late Clusters, Early Clusters, Fuggles and Red Vine. *Planting*. Hills are now generally established at 8 feet apart, one or two cuttings being inserted in each hill. *Cultivation*. Practice varies considerably, some growers cutting immediately after harvest and burning, others leaving to the spring. Cultivation proper begins early and continues till the plants are well armed out. *Pruning*. Excess shoots are removed. *Training*. Hops are grown on poles or trellises, mainly the latter. These may be high [apparently much as in England—Ed.] or low with poles only about 8 ft. high. Various forms of stringing are used with the high trellis system. Training begins when the shoots are 2 ft. long, 1-3 vines being usually trained to each string. As soon as the desired number are trained, the lowest pairs of leaves are removed to prevent the spread of downy mildew. When the vines reach the drop wires all side arms and leaves are removed from the vines below the point at which the strings are tied together. *Harvesting*. Machine picking has not yet ousted hand picking, the hops picked by hand under proper supervision being cleaner and freer from leaves and stems than those machine picked. *Drying* is done either in natural-draught stove kilns in which the hops are heated by a stove or furnace placed under the floor or in forced draught kilns in which a current of heated air from outside is forced

in or drawn through by a fan. The drying process is described in some detail. *Curing, baling and storing.* Curing is done after drying by piling in large heaps and allowing to stand for 10 days to 2 weeks. They are then baled after compression to approximately 11 lb. per cubic foot or, if for export, much more tightly up to 43 lb. per cubic foot. They are baled in jute bagging and bales normally weigh some 185-210 lb. *Diseases.* The more serious diseases to the American hop grower are downy mildew, sooty mould, various root rots, virus diseases, powdery mildew (mainly confined to N. York) and crown gall. *Pests.* Among the more important are the hop aphid (*Phorodon humuli*) and common red spider (*Tetranychus telarius*).

1399. ALGAZIN, V. S. 633.52.1-9

***Lavatera thuringiaca* L. a new source of fibre.** [Russian.]

Sovetsk. Bot., 1939, No. 3, pp. 82-90, bibl. 15.

In Western Siberia wide areas are covered with wild *Lavatera thuringiaca* L. which gives a high quality fibre.

1400. HUTCHINS, A. E. 635.1/7

Vegetable gardening.

Ext. Bull. Minn. agric. Ext. Div. **174**, 1938, pp. 32.

The Minnesota home vegetable gardener's *vade-mecum*.

STEWART, F. C., AND PRESTON, C. 633.491 : 581.13

Metabolic processes of potato discs under conditions conducive to salt accumulation.

Plant Physiol., 1940, **15** : 23-61, bibl. 45.

STEWART, F. C., STOUT, P. R., AND PRESTON, C. 633.491 : 581.13

The balance sheet of metabolites for potato discs showing the effect of salts and dissolved oxygen on metabolism at 23° C.

Plant Physiol., 1940, **15** : 409-47, bibl. 51.

SILENKO, Z. V. 633.494 : 581.056

The northward expansion of the cultivation of the Jerusalem artichoke. [Russian.]

Sovetsk. Agron., 1939, Nos. 10-11, pp. 54-7, bibl. 9.

HESTER, J. B., AND SHELTON, F. A. 635.64 : 631.83

The availability of replaceable potassium to tomatoes on a Sassafras sandy loam.

J. Amer. Soc. Agron., 1940, **32** : 563-9, bibl. 4.

BOHN, G. W., AND TUCKER, C. M. 635.64 : 632.48

Studies on *Fusarium* wilt of the tomato. I. Immunity in *Lycopersicon pimpinellifolium* Mill. and its inheritance in hybrids.

Res. Bull. Mo. agric. Exp. Stat. **311**, 1940, pp. 82, bibl. 164.

MOORE, E. S., AND ANDERSSSEN, E. E. 632.8 : 633.71 + 635.64

Notes on plant virus diseases in South Africa.

I. The Kromnek disease of tobacco and tomato.

II. [MOORE, E. S.] Die-back (mixed virus streak) of tomatoes.

Sci. Bull. S. Africa Dep. Agric. **182**, 1939, pp. 43, being *Plant Industry Series* **38**.

FLOWER GROWING.

1401. VAN SLOGTEREN, E. 635.944 : 631.544

The early forcing of daffodils.

Meded. Lab. Bloembollenonderzoek, Lisse, **59**, pp. 10, bibl. 10. Reprinted from *Herbertia*, 1938, Vol. **5** (American Amaryllis Soc. Orlando, Fla).

Flower formation in daffodils begins much earlier than in other bulbs and may start 2½ months before the bulbs can be lifted. The optimum temperature before the bulb is lifted is rather low. Bulbs in which the flower has been completely formed at lifting can be stored at 46-48° F. Lifting in normal climates is usual in August. If the bulbs have been lifted earlier or the flower is not completely formed they may be stored at 62° F. until the flower parts are completed. In a very early climate there is danger of too long cooling. Storing at 46-48° F. should therefore

not begin until the end of July for early forcing, and bulbs should not be potted before the soil temperature has dropped to 46-48° F. These methods result in flowers being produced 4-6 weeks earlier and in about half the time than when unprepared daffodils are forced.

1402. VAN SLOGTEREN, E. 635.944 : 631.544
 Vroegbroei van narcissen. (**Forcing narcissi.**)
Meded. Lab. Bloembollenonderzoek, Lisse, 60, 1938, pp. 8. Reprinted from
Kweekersblad, 1938, 14 April.

The information is substantially the same as that provided in *Meded.* 59 (see abst. 1401) except that it was written for Holland instead of U.S.A. and more details are given of the requirements of a number of popular varieties. Mrs. E. H. Krelage, for instance, under normal forcing conditions, i.e. without pre-treatment of the bulb, is a late flowering sort. By appropriate treatment it becomes one of the earliest. These pre-treatments consist in storing the bulb at various temperatures for various periods and would not be possible to the ordinary amateur without special equipment, but are very valuable to those engaged in the flower forcing industry.

1403. BEIJER, J. J. 635.944
 Preparatie van narcissen voor het zuidelijk halfrond. (**Preparation of narcissi**
for the Southern Hemisphere.)
Meded. Lab. Bloembollenonderzoek, Lisse, 61, 1938, pp. 6.

Narcissus bulbs sent without treatment to the Southern Hemisphere may take several years before they get in step with the changed seasons, and meanwhile flowers are not produced and the plant is generally unhappy. Bulbs subjected in Holland to a special treatment before shipment have succeeded well in Buenos Aires and South Africa, flowering in the cold season for those countries, i.e. about July-August and producing exceptionally fine blooms. The treatment is as follows:—The bulbs are lifted in August and stored at 30° C. until 15 October, then at -0.5° C. until 1 January and from there on until shipment, which is usually in March, at 25.5° C. The bulbs used in the experiments were Tresserve and King Alfred, both noted for their very large blooms, Spring Glory and Victoria. Victoria was the least successful and is not recommended.

1404. VAN SLOGTEREN, E., AND CREMER, M. C. 635.944 : 632.77
 De narcis-vlieg, *Merodon equestris*, en hare bestrijding. (**Narcissus fly and**
its control.)
Meded. Lab. Bloembollenonderzoek, Lisse, 62, 1939, pp. 20.

The following treatments have proved effective in Holland in the control of the narcissus fly. The experiments lasted two years. Hot water treatment of the bulbs for 1 hour at 43.5° C., for 1½ hours at 42.5° C., or for 2 hours at 40.5° C. If the treatment is done competently there will be no subsequent loss of crop, in fact the crop will be increased. Points to note are that the treatment is not considered to have started until the water has again reached the correct temperature after the bulbs have been immersed and that total submersion of all bulbs is necessary. Longer treatments than those specified will do no harm, and there is no need to grade the bulbs. If there is any sign of bulb rot or if a variety susceptible to this is being treated ¼% of gemesan or aretan should be added to the water. Some growers are afraid to give the treatment more than one year in succession. Actually, if properly done, treatments can be given year after year without harm, but if only all growers would treat their bulbs, the fly would be so reduced that it would very soon be unnecessary to do so annually. There is an idea among growers that the season following treatment bulbs that have undergone it are more heavily attacked than untreated bulbs growing in the vicinity. The fly does not lay its eggs on one more than on the other but on the treated bulbs life is easier for the fly maggot because there is no competition from various other pests and the parasites themselves will have been reduced. The author says that this merely proves his point that hot water treatment should be universal. It should be noted in connexion with increased infestations that they are encouraged by sheltered positions and that the direction of wind at the time the fly is ovipositing has an influence on its movements.

1405. GREGORY, P. H. 635.944 : 632.4
The control of narcissus leaf diseases. I. White mould and fire on "Golden Spur".
Ann. appl. Biol., 1940, **27** : 338-47, bibl. 8.
 Use of bordeaux mixture 4-4-40 or 4-3-40.

CITRUS AND SUB-TROPICALS.

1406. FAUVEL, J. H. 634.322
 Le groupe des oranges-mandarines Satsuma. Étude des variétés, des porte-greffes et des mutations de rameau. (**Varieties, stocks and bud mutations of the Satsuma orange.**)
Fruits Primeurs, 1940, **44** : 39-46, 55-8.

There are six varieties of Satsuma orange, the original of the group having been cultivated in Japan for over 300 years. These are described. The variety Owari seems to be most suitable for North Africa, being of good quality, easily grown and saleable. It is, however, prone to variation, being influenced by soil conditions, manures, climate and especially by the rootstock. In Japan the principal stocks are *Poncirus trifoliata* (trifoliolate orange) and *Citrus Junos* (Yuzu). The former has a dwarfing effect but without reduction in length of productive life. It invariably overgrows the scion. The Yuzu is of Chinese origin and is still found wild in Yunnan and other provinces. It is grown as an edible fruit in Japan, and for this reason and because the fruits are eaten young before the seeds are fully ripe seeds are often scarce. It is slow growing and can only be grafted when 3 years old (*Poncirus* at 2 years old) and is said to impart an improved quality to the fruit of its scion. Owing to differences in rooting *Poncirus* is recommended as a stock for damp or irrigable soil while Yuzu is better on drier soils or on those which are deficient in moisture for part of the year. To counteract the dwarfing effect of *Poncirus* on the scion Yuzu is often approach-grafted to the stem of *Poncirus* so that the resulting tree has two sets of roots.* In U.S.A. Webber is conducting stock trials for the Satsuma. At present *Poncirus trifoliata* is used commercially, but these trials indicate *Citrus Webberi* and the calamondin (*Citrus microcarpa*), both deep and fibrous rooting sorts, as having interesting possibilities. In North Africa *Poncirus* alone is used, but being polyembryonic the stock is liable to get mixed if the sexual seedlings are not weeded out, which they seldom are. The Yuzu should be tried, this variety apart from other advantages being monoembryonic and self-fertile. In the matter of bud mutation the recommended variety Owari often mutates into the variety Wase and more remarkable, indeed unique in cultivated oranges, is the fact that Wase will sometimes mutate back into Owari.

1407. LINE, C. W. J. 634.3
Citrus work in the Central Provinces of the Gold Coast.
Paps. 3rd W. Afr. agric. Conf., 1938 (received 1940), Vol. **I**, *Gold Coast Section*, pp. 7-10.

An account is given of the progress achieved to date in the cultivation of citrus in the Gold Coast. Limes have already proved a success, over 2,000 acres being now grown, but the market is already saturated and further planting would be unlikely to pay. Local varieties of citrus proving of poor quality a number of popular commercial varieties have been and are being planted, of which a list is given. The nursery work involved in establishing and propagating varieties for distribution is described. Stock selection is carefully done with the object of using only apogamic seedlings. The principal stocks are rough lemon and sour orange. The latter is more difficult to bud but only because the work requires to be done more carefully. Buds from mature trees take better than those from young trees. Fruit piercing moth is very serious for one month of the year. In addition to normal methods of control an attempt is being made by the use of different stocks slightly to shift the fruiting season so as to avoid the critical period of moth attack. There is a satisfactory local market for canned grapefruit, local varieties

* For further information on these and other citrus rootstocks see Investigations on the standardization of citrus trees by propagation methods, *Technical Communication* No. 3, Imperial Bureau of Horticulture, East Malling, 2s.

being used until the more recognized kinds can be produced in quantity. Flavour improves up to 9 months and decreases after 12 months, but the contents keep indefinitely. The tins are retailed at 6d.

1408. MARLOTH, R. H. 634.3 : 581.149

South Africa's oldest living citrus trees.

Reprinted from *S. Afr. J. Sci.*, 1939, 36 : 189-92.

The author does not pretend to exact knowledge but he does produce evidence tending to show that the oldest citrus tree in S. Africa is a seedling orange in the Clanwillian district. When this tree was burnt down in 1925 it was from 150-160 years old. Suckers have now grown out from the roots to form a fresh tree. There are plenty of seedling citrus in the Union over 100 years old. The author's observations and enquiries show that the oldest trees in California may well be over 100 years. From Florida comes news of a seedling orange grove of over 90 years and of a seedling grapefruit just over 100 years old. As regards profitable bearing it may be noted that certain seedling orchards 30-40 years old [orange?—Ed.] in the Rustenberg district of the Transvaal yield an average of 20 packed export cases per tree of high quality though seedy fruit.

1409. SCHULTZ, E. F. 634.31

Variedades de naranjas. . . . (Suitable orange varieties for satisfying home requirements in the province of Tucuman.)

Circ. Estac. exp. agric. Tucuman 75, 1939, pp. 6.

The following are suggested as suitable mid-season or late orange varieties for new planting to satisfy the home market in Tucuman :—Ruby Blood, Jaffa, Dulce del Mediterraneo, Lue Gim Gong, with Valencia Late as a second string among the late varieties. Specially good local varieties might also be planted on a limited scale. Parson Brown and Hamlin are recommended for planting in districts favourable to early fruit production.

1410. SCHULTZ, E. F. 634.3-1.541.11

Porta-injertos para citrus recomendables en general. (Citrus rootstocks.)

Circ. Est. exp. agric. Tucuman 80, 1939, pp. 16.

The sour orange is found ordinarily to be the best rootstock for citrus in the district round Tucuman both under irrigation and without it. In long droughts on this stock it appears better to leave unwatered than to give periodical irrigation with consequent salt accumulation. Trifoliolate stock is not so good except in certain coastal regions. Trifoliolate should not be used for Marsh Seedless grapefruit, for Jaffa or Dulce del Mediterraneo orange or for Villa franca, Lisbon or Eureka lemon. It is not recommended for late varieties since it accelerates fruit ripening. Rangpur (orange) causes quick fruiting, the fruits being of very good quality and keeping well. It is suitable for mid-season and early ripening citrus, but not for late varieties, especially in deep and dry soils. As regards mid-season varieties, it will hold its fruits better than sour orange through times of hot wind and of excessive temperature. Rough lemon has shown no advantage over sour orange and cannot be recommended for new plantings. Triumph grapefruit shows considerable promise as a rootstock for grapefruit or lemon but needs further investigation.

1411. SIMONS, J. 634.3-1.541.11

Superior nursery behavior of some citrus rootstocks.

A.R. Puerto Rico agric. Exp. Stat. 1937-8, 1938, pp. 85-6.

The local Puerto Rico grapefruit proved markedly superior as a stock for limes and lemons in competition with a number of other common citrus stocks. Davao lemon was the runner up. The P.R. grapefruit excels in rapidity and vigour of growth, ease of transplanting, freedom from scab and general compatibility with its scions. Rough lemon made the poorest growth, sour orange and rough lemon were most infected with scab, the latter very heavily. Cleopatra orange transplanted badly. In a subsequent brief note by this author and 2 others P.R. grapefruit and rough lemon are reported to be the 2 best stocks for Duncan grapefruit. [But see also following abstract.—Ed.]

1412. SIMONS, J. 634.33-1.541.11

Rough lemon superior as rootstock for limes and lemons.

A.R. Puerto Rico agric. Exp. Stat. 1938-9, 1939, pp. 80-2.

Under field conditions on silty clay 7 months after transplanting only 7% of trees grafted on rough lemon had been lost. The losses on other stock in similar conditions were *Citrus mamis* 50%, Fletcher grapefruit 32%, Davao lemon 25%, *Citrus grandis* Alamoén 17%, native grapefruit 17%. The Davao lemon rootstock grows faster than the scion, resulting in imperfect union and subsequent losses. [In the report for the previous year other qualities of the rough lemon are less highly rated.—ED.]

1413. HAAS, A. R. C. 634.3-1.415

Relation of pH to growth in citrus.

Plant Physiol., 1940, 15: 377-407, bibl. 7.

The writer describes the results of experiments with Eureka lemons budded on sweet orange in culture solutions in the open, with Valencia orange cuttings in solutions, and with Lisbon lemon cuttings in soil cultures in which the pH was adjusted. He notes the effect of the source of nitrogen on lemon and on orange cuttings, and the effectiveness of copper sulphate on the pH in lemon cultures. He describes growth of lemon in cultures containing toxic amounts of boron and finally growth of lemon cuttings in soil cultures out of doors. He finds that citrus, while tolerating extremes in their nutrient medium, will grow better in acid rather than alkaline solutions. The idea that trees can grow well in a soil showing a pH of 8.5 or higher is based on faulty methods of computing the soil samples for pH determination. In computing this it must be remembered that the amount found will depend partly on soil moisture content. The conclusion is reached that citrus under irrigation in California are grown primarily in an acid rather than an alkaline medium and that the acidity is far greater than has previously been assumed.

1414. IVANOV, S. M. 634.3-2.111: 581.192

Activity of growth processes—principal factor in frost resistance of citrus plants.

C.R. Acad. Sci. U.R.S.S., 1939, 22: 277-81, bibl. 18.

The author made experiments in 1937-38 with mandarin, orange and lemon plants exposing them to freezing in cooled chambers and finding out the amount of sugars and of reduced glutathione in the twigs and leaves. No relation could be established between frost resistance and sugar content. Figures are given of data obtained. It has already been shown possible to increase the frost resistance of citrus plants by exposing them for several nights to the action of temperatures either just above or just below freezing. This increase was found to tally with a decrease in the amount of reduced glutathione, but not with the water content, or amount of sugars or activity of catalase, etc. The following conclusions are drawn:—(1) The chief factor in the resistance of citrus to frost is the ability of the plasma to withstand the coagulating influence of low temperature. (2) The stability of the plasma depends inversely on the activity of growth and the related functional activity of the cells. (3) Since the amount of reduced glutathione characterizes the activity of growth processes, it can serve as an indirect indicator of the relative frost resistance of plants. The author thinks it highly likely that the same applies also to plants other than citrus.

1415. IVANOV, S. M. 634.3-2.111: 581.036

Importance of temperature conditions in the hardening of citrus.

C.R. Acad. Sci. U.R.S.S., 1939, 25: 440-3, bibl. 9.

In 1937-8 a study was made of the influence of temperature conditions on the hardening of lemons, oranges and Unshiu mandarins worked on *Poncirus trifoliata*. The plants were grown in pots and hardened in cooling chambers. In the first set of experiments the plants were hardened at +6° and at +2° C. for 8 nights. The range of natural day maximum temperatures during this period was 14.2 to 24.4° C. and the minimum temperatures ranged between 8.5 and 11.6° C. There were indications that the plants became harder the lower were the positive temperatures during the night. Increase in frost resistance was found to be primarily due to decreases in the amount of glutathione in the plants. In some cases hardening resulted in an increase of the sugar content. The total amount of water in the leaves also changed during the hardening. In the second set of experiments the effect of negative temperatures was tested on

the same plants, i.e. plants hardened at $+2^{\circ}\text{C}$. for 8 nights were further hardened at -2°C . for the same period. During the day the plants were under natural conditions. The mean daily maximum temperature during the experiment was 15.3° , the controls were hardened under minimum temperature conditions ranging from 7.8 to 14.6° . The results, which are tabulated, indicate that lemons become slightly more frost resistant after hardening at negative temperatures (-2°C .), but attain their highest degree of frost resistance when hardened at positive temperature ($+2^{\circ}\text{C}$.). Mandarins and oranges hardened to a less degree at positive temperatures than at negative temperatures. Under equal hardening conditions (8 nights at $+2^{\circ}\text{C}$. and for the same period at -2°C .) the frost resistance of lemons increased somewhat more in comparison with the control than that of the mandarins, which show a considerably higher relative frost resistance. The main internal cause of the frost resistance increase during hardening is the slackening of the growth processes. This is shown by the decrease in the amount of reduced glutathione in the plants as they become more hardy.

1416. IVANOV, S. M. 634.3-2.111 : 581.035

Influence of light intensity on the hardening of citrus plants.

C.R. Acad. Sci. U.R.S.S., 1939, 25 : 444-6, bibl. 3.

In experiments carried out in 1937-8 with lemons, oranges and Unshiu mandarins in U.S.S.R., which are described here in detail, the following conclusions were reached :—Light intensity has a double influence on hardening. (1) It changes the temperature of the plant, thus changing the intensity of the growth processes. (2) It affects the energy of photosynthesis and increases the sugar content, resulting in increased frost resistance under most favourable light conditions. The main reason for improved hardness is the change in the plasm due to the slackening of the growth processes. The sugar content in more frost-resistant plants need not necessarily be higher. The response of the three citrus species to variation in light intensity was different, the lemons being the most susceptible.

1417. TURRELL, F. M., AND KLOTZ, L. J. 634.31 : 581.12 : 632.19

Density of stomata and oil glands and incidence of water spot in the rind of Washington Navel orange.

Bot. Gaz., 1940, 101 : 862-71, bibl. 5.

The mean stomatal density for Washington Navel orange fruits from plots at Riverside, Calif., was found to be 13.86 per square millimetre. Density was greater in small than in large oranges. The mean density of oil glands was 2.33 per square millimetre. These were more densely distributed on small than on large oranges. Neither density of stomata nor of oil glands was found to be correlated with water spot incidence.

1418. OPPENHEIMER, H. R. 634.334

How to produce summer lemons in Palestine.

Hadar, 1940, 13 : 169-70.

The production of out of season lemons in Palestine by withholding irrigation has been the subject of further experiments.* The variety Local Great failed to respond, but considerable success was obtained with Villafranca, Eureka and Myers at the Rehovoth Research Station. The treatment given was the suspension of irrigation from 18 August to the last week in September and the application of a complete fertilizer during the second irrigation. The trees fruited heavily. In a private grove of Eureka lemon, with water withheld from the end of August to 8 October, equally good results as regards blossoming were obtained but fruiting was less than at the Research Station for causes not ascertained. There was, however, a good crop which should have ripened in July when lemon prices are highest.

1419. VITTORIA, A. 632.754 : 634.3

Sulla causa della "fétola" e sui mezzi di lotta relativi. (The cause of fetola disease of citrus and suggestions for control.)†

Ital. agric., 1940, 77 : 355-7.

This is a progress report by one of the staff of the Portici Entomological Laboratory on investigations in Sicily into the cause and cure of fetola in oranges and mandarins. The author's work

* First communication *Hadar*, 1938, 11 : 231-2, 244. *H.A.*, 8 : 1144.

† See also *H.A.*, 9 : 977 and 10 : 206.

to date has shown that the disfiguring phenomena known as fetola are due to the punctures of an *Empoasca* species. The life history of the parasite is being examined. It would appear to live part of its time on bean and potato plants, transferring from them when they dry up largely on to growing cotton plants, on which it stays till September, when it migrates to citrus. It is suggested that the most economic control is provided by spraying the citrus with hydrated lime (2% spent lime solution) in August-September and repeating the treatment when necessary. There is no difficulty in cleaning the fruit from the residue while the lime prevents the insect puncturing the fruits. Other remedies suggested include spraying with lime-sulphur and with bordeaux.

1420. FAWCETT, G. L. 634.3-2.4 + 2.1

Observaciones sobre algunas de las enfermedades presentes en los cítricos de Tucumán. (Notes on certain citrus diseases found in Tucuman.)

Circ. Estac. exp. agric. Tucuman 77, 1939, pp. 5.

Pests are considered of more importance to citriculture in Tucuman than diseases. The diseases noted here include:—gummosis (*Phytophthora* spp.), anthracnose (*Colletotrichum gloeosporioides*), *Septoria Citri*, psorosis, verrucosis, (*Sphaceloma* spp.), melanosis (*Diaporthe Citri*), exanthema, chlorosis.

1421. KLEIN, H. Z., AND PERZELAN, J. 632.752 : 634.3

A contribution to the study of *Pseudococcus comstocki* in Palestine.

Hadar, 1940, 13 : 107-10, bibl. 1.

The spread in the citrus groves of Palestine of the apparently newly arrived mealy-bug, *Pseudococcus comstocki*, (first recorded in 1937) has been very rapid. In citrus groves where there was serious infestation nearly half the seasonal crop was affected and there was little or no blossoming in the following season. The life history of the pest is here outlined. Several predators and parasites are known. Control measures are not dealt with.

1422. COTTERELL, G. S. 634.3-2.78

Citrus fruit-piercing moths—summary of information and progress.

Paps. W. Afr. agric. Conf., 1938 (received 1940), Vol. I, Gold Coast Section, pp. 11-21.

The paper follows the lines of the paper on these fruit moths in Sierra Leone (*Othreia* (*Ophideres*) *fullonica* and *Achaea obvia*) by E. Hargreaves, *Bull. entom. Res.*, 1936, 27 : 589-605 with additional notes from the Gold Coast.

1423. FENNAH, R. G. 634.3-2.7

Citrus pests investigation, Windward and Leeward Islands. Fifth progress report.

Being report on work during the period December 1939-August 1940, pp. 11 (Stencilled).

DE JONG, W.

634.3

Eenige samenvattende gegevens omtrent de djerboekcultuur in het district Poedjon. (Citrus growing in Poedjon district (Java).)

Landbouw, 1939, 15 : 760-88.

1424. GOULD, H. P. 634.451

The oriental persimmon.

Leaf. U.S. Dep. Agric., 194, 1940, pp. 8.

Diospyros Kaki, more commonly known as the Japanese persimmon, is a native of China and was introduced from there to Japan, whence it came to the U.S. A census in 1930 showed that of the different United States California had by far the most trees, some 98,000 of bearing age and 97,000 of non-bearing, followed by Florida with 13,000 trees of bearing and 17,000 trees of non-bearing age. A discussion of problems of fruit setting is followed by a list and description

of some 15 varieties including Gailey, which is an extremely efficient pollinator. Propagation is by grafting on seedling stocks of the native persimmon. Lately, however, successful grafting has been done on seedlings of *Diospyros Lotus*. This stock is topped at ground level and grafted there at a time when spring is approaching but both stock and scion are quite dormant. Hints are also given on cultivation, pruning etc., marketing and use.

1425. ANON.

633.492

Sweet potato (*Ipomoea Batatas*).*Malay. agric. J.*, 1940, 28 : 221-5, bibl. 2.

The methods of growing sweet potato should present no mysteries to dwellers in the tropics. A few points only are therefore abstracted from the article. The soil producing maximum development is friable and deeply cultivated. The Chinese in Malaya often use a very sandy soil well supplied with pig manure and this results in large tuber production without excessive vegetative growth. On too rich soils the tuber production suffers as a consequence of the too luxuriant vegetation. Semi-mature portions of stem are used as cuttings, earlier growth and heavier yield being obtained from these than from middle or basal cuttings. The latter are inferior. Continuous cropping, if a few tubers only are needed, can be ensured by planting at intervals of 2-4 weeks. Watering in dry weather is important. For distribution to a distance planting stock is best sent in the form of small tubers which are planted on arrival and used as a source of cuttings as they grow. Ten tons per acre of cattle manure before planting have given good results at the Serdang Experiment Station, Malaya. In the absence of this a turned-in leguminous cover + 150 lb. rock phosphate + 50 lb. sulphate of potash per acre was effective on a light soil. The potash encourages the formation of starch in the tubers. The crop should be lifted when mature to avoid borer attack. Maturity is indicated by the rapid drying of the sap into a white crust in cut tubers. The vines can be grown for pig feeding and probably for cattle. In this case the vines are cut every 4-6 weeks and the tubers well dosed with liquid manure to encourage fresh growth. The vines should be boiled before feeding to liberate the poisonous hydrocyanic acid, the water in which this is done being, of course, subsequently discarded.

1426. SUGAWARA, T.

633.492 : 663.61 : 581.084.1

Flowering and fruiting in sweet potato induced by water culture.*Jap. J. Bot.*, 1940, 10 : 335-42, bibl. 16.

Stem pieces 30-40 cm. long of several varieties of sweet potato were set in gravel in a bamboo basket in a nine litre enamel pot. The nutrient solution used was a modification of Kasugai's solution and its composition is given in detail here. In addition small amounts of manganese and boron were added. The pH of the solution varied from 6.0 to 6.4. The solutions were changed every 3 days, the transpiration loss being compensated by the addition of tap water in the latter stages of the trial. About 10 days after setting the pots were divided into three groups, one being put out of doors, one in the glasshouse [cool? ED.] and one in the greenhouse [heated?—ED.]. Seven weeks later one variety, Taihaku, flowered under open air and glasshouse conditions, but under greenhouse conditions grew rapidly but did not flower. In the autumn and winter several other varieties were induced to flower, but negative results were obtained with one or two varieties throughout.

1427. AKIMOTO, S.

633.492 : 581.145.2

Attempts to hasten flowering in sweet potato. [Japanese.]*Agric. Hortic.*, 1939, 11 : 993-8, [summarized in German, *Jap. J. Bot.*, 1940, 10 : (33)].

The raising of new sweet potato varieties depends on breeding, which is made more difficult in this plant in Japan by its infrequent flowering. The author has tried to stimulate this in three ways, namely, grafting on a related tuberless plant, water culture and exposure to decreased lighting. The two last methods were not very successful, but grafting on *Pharbitis Nil* was successful. Self-crossing the flowers so obtained resulted in a set of fruits varying from 5% to 0.8%, but cross pollination resulted in sets varying from 16.3-58.1%. [From summary in *Jap. J. Bot.*]

TROPICAL CROPS.

1428. HILL, E. B., AND DESCARTES, S. L. 338 : 63
An economic background for agricultural research in Puerto Rico.
Bull. Puerto Rico [ins.] agric. Exp. Stat. 51, 1939, pp. 61, bibl. 12.
 Sugar cane products constitute about 75% of the net exports in Puerto Rico. They are followed by tobacco 11.3%, textiles 9.7%, fruits and coconuts 3.0%, others 2.0%. Coffee exports are very low. The acreage under tobacco is declining. Among important exports are pineapples, grapefruit, coconuts, cucumbers, tomatoes and peppers. It is thought that research should be directed especially to sugar cane, coffee, and the production, grading and marketing of vegetables.
1429. HARDY, F. 631.4
A provisional classification of the soils of Trinidad.
Trop. Agriculture, Trin., 1940, 17 : 153-8, bibl. 22.
 The article is based on an unpublished 29 page typescript report to the Director of Agriculture, Trinidad and Tobago, describing a Reconnaissance soil map and a Tentative land productivity map of Trinidad, compiled in May 1939 by Dr. E. M. Chenery, Soil Chemist, Department of Agriculture, as an outcome of 3 years intensive work in continuation of investigations on the soils of the Colony. The scheme of classification considers natural drainage, soil structure, plant nutrient status and absence of harmful factors. There is also a productivity rating by which 5 grades of fertility are recognized for cacao, sugarcane and manured citrus. These grades do not necessarily coincide for all 3 crops.
1430. CHALLIS, B. G. 551.5
Climatic notes on New Guinea.
N. Guinea agric. Gaz., 1939, 5 : 3 : 8-27.
 A very detailed account is given of the climate on N. Guinea and adjacent islands. There is considerable variation between districts due to differences in altitude, rainfall, exposure etc. A series of tables gives meteorological data for a number of representative districts and rainfall tables for about 56 localities are also provided. The paper should prove very useful to planters.
1431. CLEARE, L. D. 631.67
A simple water lift.
Trop. Agriculture, Trin., 1940, 17 : 192.
 This water lift consists of a wooden tube through which a series of paddles pass on an endless belt, the motive power being supplied by a hand (breast) wheel at the upper end, the belt passing around a drum on the axle of this wheel and a similar but smaller drum at the lower end. The lower end of the contrivance is placed in the water and, as the hand wheel is turned, the paddles lift the water up the tube delivering it at the top whence it may be led to or from a particular area. Details of construction are given in drawings and there is a photograph of the finished apparatus.
1432. GEORGI, C. D. V. 632.951.1 : 615.778/9
The outlook for derris.
Malay. agric. J., 1940, 28 : 358-66, bibl. 2.
 The present trade position and future prospects for derris are discussed. There is at present prices little chance of growing derris profitably under estate conditions though as a catch crop with young rubber it may be worth while, particularly if a strain be used of high yielding root capacity such as *D. elliptica* Sarawak creeping. The average toxic content of 6% rotenone and 21% ether extract makes it acceptable to the market. The export of living derris for planting abroad is at the moment not permitted from Malaya. This is understandable, since after years of research in that country proved strains of high quality planting material have been isolated, which, it is hoped when conditions are again normal, will profoundly affect the utilization of derris as an insecticide in the future with justly-earned financial benefits to the country which evolved them.

1433. HENDRICKX, F. L. 632.2/7
 Observations phytopathologiques à la station de Mulungu en 1938. (**Phytopathological observations at Mulungu.**)
Rapport annuel pour l'exercice 1938 de l'institut national pour l'étude agronomique du Congo Belge [I.N.E.A.C.], part 2, 1939, pp. 117-28.

A brief review is given of the depredations of the principal pests and diseases of crops at the Mulungu research station in the Belgian Congo.

1434. HING, T. K. 633.526.23
Developmental morphology of the leaf of maguey.
Philipp. Agric., 1940, 29 : 185-225, bibl. 25.

The paper presents a detailed study of the structure and leaf development of *Agave cantala* Roxb. The tensile strength of retted fibres was very much lower than that of hand-scraped fibres. In the hand-scraped fibres those taken from leaves forming angles with the main axis of 30°-60° were strongest, but in retted fibres the leaves at an angle of from 0°-30° gave the highest tensile strength. The basal portions of hand-scraped fibres were always stronger than the distal portions. The inner fibres were stronger than those on the periphery. Hand-scraped fibres are composed mainly of the median line bundles with phloem and bundle caps intact. The retted fibres are composed mostly of smaller broken bundle caps, and contain numerous peripheral bundles which are weaker than the median bundles.

1435. WILLIAMS, C. H. B., AND CAMERON, C. 633.61
Field experiments with sugar cane IX.
Sugar Bull. Brit. Guiana Dep. Agric. 9, 1940, pp. 1-54.

- WILLIAMS, C. H. B. 633.61
The variety and fertilizer position of the sugar industry VI.
Sugar Bull. Brit. Guiana Dep. Agric. 9, 1940, pp. 55-62.

The results of 39 variety and 18 manurial trials harvested in the year ending 30 June, 1940, are here recorded.

As regards manuring the recommendation is made, subject to the exigencies of war conditions, that varying quantities of sulphate of ammonia shall be added yearly to plant canes and to ratoons. In some cases limestone will be necessary to set off the acidity. Substitutes of other materials such as nitrochalk, nicifos and nitrate of soda can be used. Phosphatic manuring would appear to be necessary, but further tests are in progress. Potash is needed in certain regions and there the muriate of potash has been found superior to the sulphate. The necessity for liming, say $\frac{1}{2}$ -1 ton limestone, at every replanting is indicated. The application of manganese ore has been without effect.

In the second paper the author deals with the economics of the addition of fertilizers under Demerara conditions.

1436. KNOCH, W., AND BORSACOV, V. 633.61 : 581.056
 Estudio comparativo de climas apropiados para el cultivo de la caña de azucar segun una nueva clasificacion climatica. (**Comparative study of climates suitable for sugar cane growing.**)
Bol. Estac. exp. agric. Tucuman 30, 1940, pp. 11.

The authors note the climates of the different regions in different continents in which sugar cane succeeds best and classify them according to heat and rainfall in one of 4 categories.

1437. CRUZ-MONCLOVA, H. 633.682 : 581.144.2
Study of the cassava root.
A.R. Puerto Rico agric. Exp. Stat. 1937-8, 1938, pp. 30-2.

Aipi Manteiga cassava dried at 65° C. and calculated on the basis of washed roots produces 28.9% of its weight of flour. Washing causes a loss of 0.51% and trimming, selecting and screening increase the loss by 6.5% of the total weight. There are intervarietal differences in keeping quality, e.g. at the normal temperature of 26° C. the M. Pichardo variety will keep for 11 days in perfect condition but Negrón Grande only 5 days. The requisites for an industrial cassava are a high yield per acre, a high yield of quality of flour per root, a high yield of starch.

In the cassavas studied flour was obtained by various methods :—(1) Preliminary pressing to remove juice, with subsequent drying at temperatures from 50°-90° C. (2) Pressing after several washings with water and drying the cake as before. (3) Grinding with peel and epidermis, without epidermis but with peel, without peel and without epidermis. In each case the quantity and quality of the flour differed. (4) Shredding. A partial separation of the shredded particles of the epidermis was possible by floating on the surface of the washing water, resulting in a high quality product at low cost. There is no analytical method of distinguishing sweet and bitter cassava. The poisonous principle is hydrocyanic acid. There is a whole series of gradations between the extremes, which are approximately 0.0270% HCN for the bitter and 0.0081% for the sweet.

1438. MOLINARY-SALÉS, E., AND JULIÁ, F. 633.682-1.8

Fertilizer experiments with cassava.

A.R. Puerto Rico agric. Exp. Stat. 1938-9, 1939, p. 89.

A yield of 217 cwt. per acre was obtained by an application of 180 lb. NH_3 , 180 lb. P_2O_5 and 120 lb. K_2O per acre. In a future experiment the applications are to be increased to 300 lb. per acre in each case.

1439. MANGEL, N. R. 633.682

El cultivo de la yuca. (Cultivation of cassava.)

Rev. C.N.A., Costa Rica, 1939, 4: 385-432.

Apparently a translation with but slight alterations from Nicholl's & Holland's *Textbook of Tropical Agriculture*, 1929, pp. 426-34.

1440. MURRAY, G. H. 633.71

Brus tobacco for natives.

N. Guinea agric. Gaz., 1940, 6: 1: 52-4.

A method of growing tobacco suitable for issue as rations to the native labourers of New Guinea is described. The curing and partial fermentation (full fermentation, though described here for those who wish to reduce "bite" and improve bouquet, is not necessary for brus) will require care, but the pitfalls are pointed out.

1441. TEA RESEARCH INSTITUTE OF CEYLON. 633.72

Tea Research Institute Sub-Conference.*

Tea Quart., 1940, 13: 4-45.

A report of the first Sub-Conference of the Institute. This conference was limited to nominees of various interested Associations. The object of these smaller meetings is to discuss matters of particular interest to any of the Associations represented. There were no formal papers but discussions in which many participated were held on the following subjects :—(1) Aspects of manufacture (dealt with piecemeal). (2) Manuring and cultivation with special reference to war conditions. (3) Pests and diseases. (4) Tea selection and propagation.

1442. LUCY, A. B. 633.72-1.531

Tea seed production and germination experiments at the Central Experiment Station, Serdang.

Malay. agric. J., 1940, 28: 215-20, bibl. 2.

Experiments in production and germination of tea seed are described. The commercial production of tea in Malaya only began in 1927. There is therefore still a good deal to learn, especially in the reaction of the plant to local conditions, which in these experiments are tropical lowlands, latitude 3° N, altitude 175 ft. The conclusions reached are as follows :—Harvesting of tea seed may proceed throughout the year. The seed yield for 9-year-old bushes under high shade is 970 lb. of tested sinkers per acre per annum. To secure good germination the seed must be extracted from the hard-walled capsules. The wet method gave a better recovery of good seed than the dry method. The former consists in mixing the freshly harvested capsules in a sufficient quantity of moist sand to keep them apart and prevent heating, and storing in a shaded shallow pit for 4 days. The sand is then removed by sieving. The treatment causes the capsules to soften and open wider so that the seeds can easily be removed without the aid

* Held at St. Coombs, March 21st, 1940.

of a knife. There were no differences in germination as a result of either method but wet cleaned seed showed the better keeping qualities. Tested sinkers which became floaters after a short storage gave about half the germination percentage of those seeds which remained sinkers.

1443. WINTER, E. J., AND BORA, M. 633.72 : 635.977.8
The species of shade trees used in tea gardens.
Memor. Indian Tea Ass. 12, 1940, pp. 18.

A number of exploratory experiments in the use of shade trees with tea have been recently laid down by the Indian Tea Association in commercial gardens. The use of shade in moderation is more or less accepted, though what constitutes moderation is still a subject for argument. The manurial effect of the fallen leaves is more important. The shade trees used are all leguminous and provide a means of harnessing nitrogen for the use of tea. Tea is very sensitive to changes in the nitrogen supply and considerable saving in applied manures can thus be effected. The disturbing factor is the liability of leguminous plants to reduce fixation in the presence of abundant soil nitrogen and there must therefore be an economic optimum density of shade for every application of nitrogenous manures. The experiments are designed to discover this optimum. The paper describes and illustrates with scale drawings of the foliage, pods and seeds a number of plants used as overhead or ground cover. The correct use of these drawings should make identification easy. There is a neat definition of an "adequate specimen" which should benefit those quite numerous persons who submit, say, one withered leaf and expect a correct identification forthwith. "An adequate specimen is one which shows all the peculiarities of the whole plant but has no peculiarities of its own."

1444. COOPER, H. R. 633.72-1.86 + 1.87
Experiments with cattle manure, humus composts and unfermented organic waste materials.
Memor. Indian Tea Ass. 11, 1940, pp. 36.

This paper records experiments on the manuring of tea which tend to prove that the claims for the wonderfully increased efficiency of materials composted by the Indore or other methods over the same materials before composting are unfounded, at least in the case of mature tea in bearing. It is also shown that composting actually loses nitrogen, that the forms that remain are less efficient than the forms in the raw material and that no evidence can be found that composting, which is often expensive and laborious, has any value beyond the nitrogen that it supplies. Nitrogen supplied as sulphate of ammonia gave twice the yield of similar qualities of nitrogen supplied as Indore or Dacca composts. The proved facts that no bad preliminary effects have followed the use of uncomposted raw organic materials on tea and that these materials are more efficient before composting than afterwards is of the greatest importance to the tea industry in view of the low cost at which efficient waste vegetables can be collected. However in the case of young tea it seems from observation, failing experimental evidence, that fermented materials like well-rotted cattle manure and good humus composts are better than the unfermented raw materials for nurseries, infillings and young tea at the time of replanting. In the paper 8 experiments are described very fully.

1445. LUCY, A. B. 633.72-1.8
Manurial experiments with tea at the Central Experiment Station, Serdang.
Malay. agric. j., 1940, 28 : 304-11, bibl. 3.

The manurial experiments with tea which are still in progress at Serdang have so far shown that a complete fertilizer or sulphate of ammonia alone will maintain the yield of tea at as high a level as will a more complex organic mixture. It is recommended that sulphate of ammonia alone be used until it is shown what elements other than nitrogen are useful.

1446. HUNTLEY-WILKINSON, C. 633.72-1.459
Soil erosion prevention on tea estates.
Tea Quart., 1940, 13 : 59-72.

The author describes measures for the prevention of erosion that he has found effective on 2 estates in Ceylon. *Contouring*. On very steep poor gravelly land no planting holes were cut and no soil removed but the contours on which the plants were to be set out, i.e. 2 ft. apart on

contours 5 ft. apart, were forked carefully and deeply without removal of soil. Since much subsoil was brought up artificial manure was mixed with the soil by hand. Intermediate lines were inserted where necessary. No drains were cut. As a result there was entire retention of soil. Later terraces were gradually cut and bordered with the grass *Paspalum dilatatum*. Planting began 1929, in 1937 the yield was 1,138 lb. per acre and in 1938, 938 lb. per acre. The author considers that if tea is planted strictly on the contour at a spacing of 3 feet, natural terraces will form and the soil will not break away between the bushes. This, however, would have reduced the plant incidence from 4,356 per acre to 2,904. *Grass terraces versus stone*. Terraces bordered with *Paspalum dilatatum* cost less and are established more quickly and are more effective than stone terraces. As soil collects it is bound by the grass and the height increases which is not the case with stone. The grass terraces require trimming back every two years but on the other hand where ground cover exists the expense of drain cleaning is saved. *Tea hedges*. Permanent terraces may be established above roads and drains by the use of tea hedges for which discarded nursery plants or collected self-sown tea plants can be used. *Shade trees* should be planted on the contour below drains because they are then easily reached for purposes of noting mortality of young plants. As a preventive of erosion contour planting of shade trees is of no great benefit. *Drains*. Open drains in districts of moderate rainfall are now discredited. They can be converted to hold up water by establishing bunds in them or by cutting out pits on the reverse slope principle, but a cheaper and more effective method is levelling the bottom of the drain in sections of 6 to the chain or slopes of 1 in 15 to 1 in 20 and using the resultant earth to form bunds on which *Paspalum* can be established. A very even distribution of water for seepage to the tea roots below is thus provided. Ravining by direct downhill drains may be checked by bunding at intervals and carpeting the bund with *Paspalum*. If the land is very steep reverse slope pits may be cut or a backward sloping stone step with a projector may be inserted (water cushion system). *Ravines* should be grassed to help in holding up water during heavy spates. *Paspalum* grass is effective and provides good fodder for cattle. All the above measures are regarded as secondary. The chief defence measure against erosion is the establishment of ground cover throughout the estate unless it already has a good stand of *Grevillea robusta*. This tree breaks the intensity of the rainfall and its continual leaf fall provides a wonderful soil cover. The effect on tea quality of an efficiently close planting of *Grevillea* is not discussed. A large number of possible cover plants, a number of them indigenous, are mentioned and notes given of their peculiarities or needs. Though some of these are leguminous, the writer remarks that he has never succeeded in establishing satisfactorily a permanent leguminous cover.

1447. GADD, C. H.

633.72-2.19

"Bitten off" disease of tea seedlings.

Tea Quart., 1940, 13 : 54-8, bibl. 6.

"Bitten off" is a destructive disease of young tea seedlings characterized by the disappearance of the finer rootlets of pulled plants. If dug up carefully the finer roots will be found to be decaying. Attempts to trace a causal organism failed and further research has indicated that the condition is brought about by excessive alkalinity of the soil. The optimum pH value of tea soil is between 5.3 and 6.5. Unsuitable conditions in which the disease may develop are the siting of nurseries where there have previously been buildings or line gardens or on soils near limestone outcrops or excessive use of compost. Excessive water is another but less common cause. It is, therefore, obvious that the suitability of the soil should be tested before the seed is sown rather than after the symptoms have occurred.

1448. RUIZ, S. R.

633.73

Estudio comparativo de las variedades de café Arábigo y Bourbon. (Comparative study of *arabica* and Bourbon coffee.)

Rev. C.N.A. Costa Rica, 1940, 5 : 121-46.

Bourbon coffee was introduced into Costa Rica at a time when *arabica* plantations had become old and decadent. The current notion that Bourbon yielded more heavily than *arabica* arose from the fact that the young vigorous Bourbon bushes did yield more than the ancient worn out *arabica* plants, but at the time there seem to have been no experiments among comparable

subjects. A fact that requires consideration is that Bourbon coffee in situations in Costa Rica which are not ideal is yielding more than *arabica* growing at its most favourable altitude, i.e. over 1,200 m. and experiences in other nearby countries show that at this altitude *arabica* should be the better yielder. In Salvador and Guatemala, which have ample experience of both varieties, it is generally agreed that for Bourbon the optimum mean temperature is over and for *arabica* under 24° C. In Costa Rica these temperatures are obtained at 1,000 m. altitude and 1,200 m. respectively. In recent trials with Bourbon and *arabica* at 1,480 m. under good cultural conditions *arabica* gave 20% the better yield. The author suggests that *arabica* coffee should be planted at the higher altitudes for the English market which gives the best prices in normal times and that at lower altitudes Bourbon coffee should be grown for the American market, where it is greatly appreciated and by its sale would provide a useful second string. It is also suggested that the two varieties might be interplanted above 1,200 m. and blended. The coffee taster at the Costa Rican Coffee House informs him that a 50-50 mixture of the two sorts has a better aroma than either alone and that Bourbon greatly improves the liquoring quality of *arabica*. A very profitable American market might be found for this blend. The author concludes, however, that it is no use growing a good thing if nobody wants it, that markets are influenced by many more important factors than small differences between varieties. A close study of the markets is the first essential and the second is to try to give the merchants what they want.

1449. GUISCAFRÉ-ARRILLAGA, J., AND GÓMEZ, L. A. 633.73
 Resultado de un estudio de las practicas agricolas usadas en 398 fincas de
 cafe en Puerto Rico. (A study of agricultural practices on 398 coffee estates
 in Puerto Rico.) [English summary.]
Bol. Estac. exp. agric. Puerto Rico 49, 1939, pp. 41, bibl. 3.

The agricultural practices on the 398 Puerto Rican coffee farms investigated seem to consist mainly of those discredited everywhere else, nevertheless, an excellent quality coffee is produced. This is largely due to the care with which the processing is done. Yield could be increased with proper farming and unless this is undertaken coffee will continue to be unprofitable.

1450. GUISCAFRÉ-ARRILLAGA, J., AND GÓMEZ, L. A. 633.73-1.535
Asexual propagation of coffee : limiting factors.
A.R. Puerto Rico agric. Exp. Stat. 1937-8, 1938, pp. 56-7.

Failing to root coffee cuttings in various stages of maturity by any one of a number of methods including synthetic hormone treatment, the authors investigated the possibility of there being no root initials in coffee stems. Coffee trees 2½ years old were buried up to the top six inches in a trench filled with clay and sand. After 5 months the plants were exhumed, when roots were found growing abundantly the whole length of the buried portion.

1451. REAÑO, P. C. 633.73 : 577.15.04
Histological study and observations on the effects of some synthetic growth substances on the stem tip cuttings of coffee.
Philipp. Agric., 1940, 29 : 87-99, bibl. 21.

Stem tip cuttings of coffee, set in propagating boxes, without bottom heat in a medium of ½ peat and ½ fine sand or in screened garden soil shaded beds in the Philippine College of Agriculture, were more stimulated to produce roots by treatment with indole-3-acetic acid and γ-(indole 3)-n-butyric acid at concentrations of from 4.5-6 milligrams per 100 millilitres of distilled water than by other synthetic rootgrowth substances tried, though the others were not ineffective. All the untreated controls seem to have died. Cuttings with leaf blades trimmed to one-half of the leaf were much more successful and rooted in half the time taken by cuttings with all or no leaves. Many more of the latter died. Suberization of the cells of treated cuttings took place 22 hours after treatment. There were no apparent structural changes in the epidermis of treated and untreated cuttings. The endodermis was the first tissue of the cortex to show marked activity and was followed by the cortical parenchyma near it. The phloem and cambium were the most responsive of the tissues activated and initiation of root primordia was associated with them. Epidermis, wood and pericycle were not activated at all.

1452. SNOEP, W. 633.73-1.541.44
 Toepassing van takenten in de practijk. (**Practical application of branch grafting coffee.**)*
Bergcultures, 1940, 14 : 482-91, bibl. 9.

The origins and differences between fan and whip shoots of *robusta* coffee are explained with special reference to their use in branch grafting, i.e. the conversion of ailing or low yielding plantation trees by grafting with scions of selected clones. Choice of scion on the parent bush is important, whether fan or whip shoots are used, as a faulty choice may lead to restricted growth. In the course of the paper it is mentioned that grafts of fan material have a marked rejuvenating effect on the root system. The angle at which the fan branches grow is also an indication of their rejuvenating powers, erect fans being the most efficient. Whip shoot grafts make trees of erect growth which take up little room and behave as expected from known clonal habit whereas fans are apt to be uncertain. Problems connected with fan grafts are the formation of a growth habit which will give maximum yield and the control of the growth habit so that the bearing wood does not extend ever farther from the tree, leaving the centres bare. In selection of scions considerable variations with the clone are encountered, so that it is quite easy, if propagating from a number of plants of one clone, to acquire an assortment of progeny differing, usually for the worse, from the original parent. This applies particularly to the angle at which the branches are held in relation to the stem, and it is suggested that the production of graft scions which develop a wide-angled branching by a parent of erect habit is because those particular scions were taken from branches on the parent tree which happened to deviate from normal in their branch angle. There are various intermediate forms between whip and fan; these have the appearance of whip shoots but later develop fans, and, if used as scions, maintain the same habit so that the fan is produced about a year after grafting and not immediately as in the case of a true fan. To obtain an immediate fan from a graft the scion used should be taken from a full fan and should have formed its pair of secondary shoots. These are cut off and their dormant basal buds will grow into fans and never into secondaries. The secondary if allowed to grow retards the development of the fan buds at its base. Intermediate fan joints with secondaries may have to be used. In this case the fan is produced by cutting off the secondaries if they do grow, i.e. if only two opposite side shoots appear. If a group of more than 2 shoots appears, these are fan shoots and can be thinned or left as required. The secondary buds may be removed before shooting if they appear swollen, but this has been found to delay the growth of the basal fan buds and sometimes to cause the graft to fail. Whip shoots present a much simpler problem. There is always an ample supply. For quick growth select scions without swollen secondary buds but with swollen "reproduction" buds, i.e. those at the base of the site of the secondary bud. For the intermediate form which starts as a whip and later fans the scion should be taken from an older whip which has begun to fan and the scion should have already developed its secondary shoots; these are cut off and can never reappear and the "reproduction" buds which start have a reasonable possibility of eventually fanning. Terminal shoots can be relied on to reproduce the desired type immediately.

1453. GUISCAFRÉ-ARRILLAGA, J., AND GÓMEZ, L. A. 633.73 : 581.144.2
Studies of the root system of *Coffea arabica* L. I. Environmental condition affecting the distribution of coffee roots in Coloso clay.
J. Dep. Agric. Puerto Rico, 1938, 22 : 227-62, bibl. 10, summarized *A.R.*
Puerto Rico agric. Exp. Stat. 1937-8, 1939, pp. 62-3.

The method of excavation used in these studies consisted in excavating the volume of soil assigned to each tree in blocks of 1 cubic foot each and separating, drying and weighing the roots in each block. The green and dry weights in each cubic foot of soil are obtained and the root distribution is mapped. The roots are removed from the soil blocks by hand and by screening. It is claimed that this method is an improvement on any others since here no roots at all are lost and the lateral and vertical distribution is accurately determined. 94% of the roots of 7-year-old coffee trees was found in the top 12 inches; this is regarded as rather higher than normal and is attributed to the humitic nature of the surface soil and poor drainage at the lower levels. Health and vigour in coffee are not to be correlated with an extensive root system. The

* Full translation available.

usual ratio of tops to roots is 8 : 1. In selecting vigorous trees for planting the diameter of the trunk is a better guide than height or lateral spread of branches. The water content of different parts was—main stem 50%, lateral branches and leaves 23%, whole tree tops 39%, roots 50%. Vertical penetration of 7-year-old trees was 3 ft. and lateral extension 4 ft. Certain recommendations are made arising from the results obtained. There should be no interplanting of surface rooted crops with coffee and, if bananas are used for temporary shade, they should be eliminated as soon as permanent shade trees are available. Shade trees should be kept to a minimum to reduce root competition. Minimum planting distance for coffee 8 ft. \times 8 ft. Deep soils are necessary, coffee on shallow soils usually fails. Deep planting must be avoided, but to induce the roots to descend deep holes may be sunk between the rows and vegetable debris mixed with chemical manures. Shallow cultivation between rows or vertical forking to loosen and aerate the soil is all the cultivation that should be attempted. Manurial treatment should be confined to the surface of the soil.

1454. GUISCAFRÉ-ARRILLAGA, J., AND GÓMEZ, L. A. 633.73 : 581.035

Different intensities of solar radiation have distinctive formative effects on the coffee plant.

A.R. Puerto Rico agric. Exp. Stat. 1937-8, 1938, pp. 57-61.

The mean intensities of solar radiation in foot candles in the open and under lath shelters admitting $\frac{2}{3}$, $\frac{1}{2}$ and $\frac{1}{3}$ sunlight for the period June 1937—May 1938 from 9 a.m. to 3 p.m. was 31,541, 21,531, 15,458 and 9,407 respectively. These differences had marked effect on the development of coffee submitted to them. Trees under $\frac{1}{3}$ and $\frac{1}{2}$ sunlight showed the more vigorous growth in lateral spread, height and trunk diameter. Under the two higher intensities the internodes of the laterals are much shorter while the leaves are smaller, leathery and yellowish. There were no soil moisture differences found at 6 inches depth between the plots under the different intensities.

1455. STOFFELS, E. H. J. 633.73-1.542

Quelques données sur les caféiers arabica à tige unique et à tiges multiples.

(Single and multiple stem *arabica* coffee.)

Rapport annuel pour l'exercice 1938 de l'institut national pour l'étude agronomique du Congo Belge [I.N.E.A.C.], part 2, 1939, pp. 114-6.

Arabica coffee is everywhere prone to suffer from die-back as the result of early overbearing. The only way to prevent this is to head back the young bush to 80 cm. at a year old ; this results in a plentiful production of leafy as opposed to fruiting shoots. In addition the two lowest branches are removed, one of the remaining topmost ones and a few lower down if and where the internodes are unduly short. Subsequent pruning aims at maintaining a suitable leaf : fruit balance. Sometimes, in spite of pruning, poor soils will cause die-back. Coffee on red laterite soils which has never fruited has been made profitable by lavish applications of compost and mulching. A correctly formed tree should have 18 pairs of primaries, regularly spaced and furnished with numerous secondary branches. The height should be from 1.30 m. to 1.50 m. In a recent recording of 20 trees secondary branches have yielded 1.8 times as much as the primaries, and the upper half of the tree, primaries and secondaries combined, produced 3.145 kg. of cherry to 2.445 kg. on the lower half. As regards shape and quality there was no difference between the bean weight and shape averages of primaries and secondaries. The average weight of the individual beans from the upper part of the bush is slightly less than for the lower half, 15.1 g. against 16.2 g. Multiple stem bushes deprived of secondaries but not cut back have excited some interest. They are simpler to prune and cultivate but their yield is less than properly cared for single stems. They are useful in districts where the excessive vegetative development affects fruiting adversely.

1456. C. 633.73 : 635.977.8

Goed opletten ! (Iets over een krachtig groeiende lamtorosoort.) (A strong growing *Leucaena glauca*.)

Bergcultures, 1940, 14 : 526-7.

A *Leucaena glauca* of exceptional vigour was discovered in a plantation of robusta coffee in which *Leucaena* was providing the shade. It was found to breed true from seed, though not

to be very prolific. The characters of young plants are strong growth, an erect stem which becomes light brown after a year and erect branches. By the second year (after planting as a stump) it becomes a shade tree of consequence. The visual difference between *Leucaena* H.V.T. as it has been named, and the ordinary *L. glauca* is shown by photographs. The tree is going to be of inestimable value in solving the shade question which has become a problem in the highlands and it will probably be useful also at lower altitudes on difficult soils where the common *Leucaena* sometimes exhibits undesirable characteristics. Comparative trials are mentioned in which the superiority of the new selection has been shown.

1457. WEST, J. 633.74
The development of cacao selection in Nigeria.
Paps. 3rd W. Afr. agric. Conf., 1938, (received 1940), Vol. 1 *Nigerian Section*,
 pp. 367-71, bibl. 5.

The progress made to date in the experimental selection of cacao in Nigeria and the difficulties encountered are described. Future development depends on the amount of local material available for selection. Introduced strains will not necessarily repeat their performance in another country. The local type is capable of very high yields and yield is the principle factor in peasant cacao farming. Further studies of growing cacao under Nigerian conditions are also needed.

1458. CHEESMAN, E. C., AND SPENCER, G. E. L. 633.74-1.535-1.16
The cost of cacao propagation.
9th A.R. on Cacao Research for 1939, I.C.T.A., Trinidad, 1940, pp. 4-5.

The propagation of cacao by cuttings is now an established technique in Trinidad. The cost per cutting is worked out and shown to be about tenpence (20 cents) made up by 2d. for capital charges on equipment, 5d. for materials, 3d. for labour. The cost of raising nursery seedlings is infinitesimal. The cost of producing a budded plant ready for the field is—capital charges on equipment 3d., materials 4d., labour 3d., total 10d. Attempts to economize by such methods as growing and budding rootstocks in the open instead of in baskets are neutralized by the added attention required in unfavourable weather to keep the stocks healthy and so minimize failure when budding. In addition growing in baskets ensures the planting material being ready when wanted, an essential condition in a supply nursery. In the section dealing with the cost of cuttings information is given as to the amount of equipment and material required to produce 7,000-9,000 cuttings a year.

1459. COPE, F. W. 633.74-1.55 : 581.162.3
Some factors controlling the yield of young cacao III.
9th A.R. on Cacao Research for 1939, I.C.T.A., Trinidad, 1940, pp. 6-12,
 bibl. 2.

Previous reports* showed that self-incompatible trees in populations of young cacao reduce the yields from those fields and that self-compatible trees carry a greater number of harvestable pods in spite of a statistically tested lower flower production. In part 3 it is shown that in two consecutive seasons, one favourable and the other the reverse, the pod production of young cacao remained unchanged. In the unfavourable year flowering intensity increased in both self-compatible and self-incompatible trees, with an increased set of cherelles. In the unfavourable year less cherelles were set per 10,000 flowers in the self-compatible trees but more in the self-incompatible. In an unfavourable year wilting of cherelles is more severe than in favourable years. All these findings are statistically significant. Commenting on this (p. 3) Professor Cheesman suggests that the second or unfavourable season was probably inimical to the agents of self-pollination and more favourable to the agents of cross-pollination and stresses the fact that until the pollinating agents are known no analysis of factors contributing to yield can be complete.

* See 7th and 8th Reports and *H.A.*, 8 : 1128 and 9 : 1408.

1460. COPE, F. W. 633.74 : 581.162.3

Agents of pollination in cacao.

9th A.R. on Cacao Research for 1939, I.C.T.A., Trinidad, 1940, pp. 13-9, bibl. 11.

Circumstantial evidence is produced to show that red ants (*Wassmannia auropunctata* Rog.) and thrips (*Frankliniella parvula* Hood) were the agents of pollination in 99 self-compatible cacao trees examined. The evidence is not regarded as conclusive. Studies of the ecology of these two insects are needed.

1461. COPE, F. W. 633.74 : 581.162.3

Studies in the mechanism of self-incompatibility in cacao I and II.

8th A.R. on Cacao Research for 1938, I.C.T.A., Trinidad, 1939, pp. 21-1, bibl. 6,

and 9th A.R. for 1939, 1940, pp. 19-23, bibl. 10.

In part I it was shown that in cases of failure of self-pollination on a self-incompatible tree no inhibition of pollen tube growth occurred in the style. In part II it is shown that pollen tube growth and fertilization are the same in both compatibly and incompatibly pollinated ovaries. Division of the polar nucleus starts later in incompatibly fertilized embryo-sacs than in those compatibly fertilized. The proportion of embryo-sacs showing polar divisions is always low in the ovary which has received incompatible pollen. At abscission less than 25% of the embryo-sacs in incompatibly pollinated flowers and over 80% in compatibly pollinated flowers at the same time show nuclear division. The fertilized egg is intact when incompatibly pollinated flowers absciss. Delayed and slow development of the fertilized embryo-sac and low level of nuclear activity in incompatibly pollinated flowers are probably responsible for abscission. When, as in compatibly pollinated ovaries, activity of the contents of the embryo sac is at a high level of intensity, then the turgor abscission mechanism does not operate.

1462. VOELCKER, O. J. 633.74 : 581.162.3

The degree of cross pollination in cacao in Nigeria.

Trop. Agriculture, Trin., 1940, 17 : 184-6, bibl. 2.

In Trinidad the author showed that a high degree of cross-pollination took place between cacao trees, ranging from approximately 50% on self-compatible trees to nearly 100% on self-incompatible trees.* Similar investigations in Nigeria indicate that about 25% of the pods on any Nigeria cacao tree are produced as a result of cross-pollination provided the tree is uniformly surrounded by others. The distance over which pollen is carried seems unlikely to extend beyond immediately neighbouring trees.

1463. HARDY, F. 633.74-1.8

Manurial experiments on cacao in Trinidad. Summary of results for 1939.

9th A.R. on Cacao Research for 1939, I.C.T.A., Trinidad, 1940, pp. 26-33.

This paper is a résumé of Dr. J. F. Pound's Progress Report on Manurial Experiments on Cacao for 1939 (begun 1932) to the Trinidad Cacao Subsidy Board. The soils of Trinidad have been divided into 5 grades according to their productivity, e.g. grade I., very high productivity, over 500 lb. dry cacao per acre, grade V., very low productivity, below 85 lb. per acre. The year's results (Sept. 1938-Aug. 1939) were characterized by the extremely small yields on both control and manured plots. This is attributed to adverse weather. The progressive decline of cacao yields throughout the island cannot effectively be arrested until the environment is rehabilitated as well as the tree. In the wild state cacao is only found on free-draining fertile loam soils of considerable depths. In present conditions in Trinidad cacao in good condition on medium to light loam, fairly witch-broom-free, and yielding at the rate of 330 lb. per acre can usually be profitably manured with pen manure and certain fertilizers. Beneficial and economic dressings are found to be 1-2 lb. per tree of superphosphate or sulphate (or muriate) of potash, followed by smaller annual applications. Potash manures continue to benefit the crop long after applications have ceased. Phosphates are useful on potash-deficient soils only after the potash status has been improved. No amount of manuring will counter adverse weather or disease conditions.

* Voelcker, O. J. The incidence of cross-pollination in cacao. 7th A.R. on Cacao Res. for 1937, I.C.T.A., Trinidad, 1938, pp. 9-14, H.A., 8 : 1217.

The interactions between cultivation and manuring need study. Advantages from draining and round-ridging without manuring were nil and suggest that these operations may be less necessary than hitherto thought to be the case. Cacao should be treated as an orchard crop and receive thorough "gardening" attention. Pen manure is useful with unsatisfactory cacao on sandy soils and in preparing the land for future artificial manuring. So far liming has not produced much result nor has forking round old trees. The remainder of the report consists of the manurial responses of different soil types in Trinidad and notes on 3 special experiments: (1) *Shading and drainage*. Shade trees may function as overhead drains, and the heavier the shade the fewer the drains needed. (2) *Spacing*. 8 ft. \times 8 ft. is a useful spacing which effects great saving in costs by keeping down the weeds. (3) *Pruning*. A new method of rather drastic pruning introduced with success produced no significant increase of yield at River Estate.

1464. HUMPHRIES, E. C. 633.74-2.19
Studies in the physiology of *Theobroma Cacao* with special reference to cherelle wilt. I. Preliminary investigation of the factors concerned in wilt.
9th A.R. on Cacao Research for 1939, I.C.T.A., Trinidad, 1940, pp. 33-42, bibl. 14.

The studies reported in this paper lead to the conclusion that the wilting of cacao cherelles is caused by some nutritional and/or water deficiency in so far as the two factors are linked together. Influence of weather on wilt was not found but the total rainfall and rainfall fluctuations were less than in normal years.

1465. HUMPHRIES, E. C. 633.74 : 581.145 : 631.8
Studies in the physiology of *Theobroma Cacao*. II. Growth rate and mineral intake by the pod.
9th A.R. on Cacao Research for 1939, I.C.T.A., Trinidad, 1940, pp. 43-6, bibl. 2.

The changes in water content of cacao pods follow a well marked cycle, being high in the early stages, then falling, rising to a maximum when rapid changes are occurring in the beans, then falling until maturity. The most rapid increase in moisture content was from the 50th-87th day, the first being the time when it is thought that the first division of the zygote takes place. The ripe pod contains 2.7 g. of K_2O , the element most in demand. Half the amount of calcium present is attained after 90 days, but half the amount of phosphorus present in the mature pod is accumulated only after 120 days.

1466. HUMPHRIES, E. C. 633.74 : 581.144.4 : 631.8
Studies in the physiology of *Theobroma Cacao*. III. Leaf flush and mineral intake by the shoot.
9th A.R. on Cacao Research for 1939, I.C.T.A., Trinidad, 1940, pp. 47-51, bibl. 2.

The change in the mineral content of the cacao shoot during development has been investigated by means of chemical analyses of weekly samples. The onset of a new flush caused a transport of potassium, nitrogen and phosphorus out of the leaf which was not made good by the tree. This possibly accounts for the short life of the leaves at this site which did not exceed 16 weeks. The phosphorus content of the leaf, expressed on the basis of 100 g. of water, remained practically constant over the period investigated. Changes in composition of leaf flushes of cacao trees is to be further studied on soils with a different nutrient status from the above.

1467. MURRAY, D. B. 633.74 : 581.13
Some preliminary studies of transpiration and carbon assimilation in cacao.
Trop. Agriculture, Trin., 1940, 17 : 166-8, bibl. 4.

1. Methods are described for measuring the loss of water and the uptake of CO_2 of attached cacao leaves in the field. 2. Results are given for the transpiration and apparent assimilation of cacao leaves under sun and shade conditions. 3. Transpiration rises to a maximum at midday whereas carbon assimilation rising in the morning falls off at midday with light

intensities over $\frac{1}{2}$ of full sunlight. 4. Shade appears to give a better environment for the leaf than full sunlight. [Author's summary.]

1468. BIRCH, H. F. 633.74 : 581.175.11

Investigation of the purple colouring matter of cacao beans.

9th A.R. on Cacao Research for 1939, I.C.T.A., Trinidad, 1940, pp. 51-2.

Attempts to isolate cyanidin, the glycoside and the hydrochloride from the purple pigment of Forastero cacao bean was unsuccessful here owing to the unstable nature of the pigment. It is suggested that in order to trace the rate of decomposition and loss of purple pigment during fermentation and to compare Forastero in this respect with Criollo, colour-comparison of extracts prepared under standard conditions might prove successful.

1469. COOPER, ST. G. C. 633.74-1.547.6

A note on the maturation period of cacao pods in Grenada.

Trop. Agriculture, Trin., 1940, 17 : 165, bibl. 1.

The average maturation period of cacao pods in Grenada is established at between 5 and 6 months. The lack of effect of season on the length of the maturation period is demonstrated. Full size is reached in the 5th month. The month of greatest increment is for length the second and for circumference the third after fertilization.

1470. GIEBERD, A. V. 633.74

Experiments in the regeneration of cacao farms in the Agege district Nigeria.

Paps. 3rd W. Afr. agric. Conf., 1938, (received 1940), Vol. 1, Nigerian Section, pp. 47-56.

The serious die-back of cacao, which is occurring in the Agege district in Nigeria where cacao formerly flourished, is under investigation, and for the purpose a number of affected farms in various stages of dissolution have been leased. Attempts will be made to render them again productive and the procedure adopted is described. The condition is thought to arise from exhaustion of the surface soil and the unfavourable state of the subsoil.

1471. WEST, J. 633.74

Experiments on cacao regeneration : Ibadan.

Paps. 3rd W. Afr. agric. Conf., 1938 (received 1940), Vol. 1, Nigerian Section, pp. 359-66, bibl. 6.

Young established cacao grows rapidly with a small amount of dry season die-back which is much exceeded by the new wood produced each wet season. Growth is greatly reduced at maturity while yield is increased. After a period of equilibrium, its length depending on environment, two general forms of dying out appear. 1 The whole or a large part of the plantation takes on an unhealthy look, the lower parts of the trees become bare and the tops stag-headed. These trees may produce a sudden crop of stem chupons before they die. 2 The tree dies suddenly, leaving a hole through which the sun's rays beat upon the soil, with the result that adjacent trees die in succeeding years and an expanding area of dead cacao results. Experimental work aims at solving the following problems:—1 Can young cacao trees be established in places where former trees have died and in vacant places under mature trees? 2 Can stag-headed or moribund trees be renewed from basal chupons? 3 How can the health and yield be maintained in a farm of mature cacao? Results so far obtained indicate that there should be no thinning of mature trees, beyond the removal of dead wood and unwanted chupons; some form of side shade to a plantation is absolutely necessary. Young plants will grow up under mature cacao though probably never so thriftily as in newly cleared forest soil. Trees have been regenerated by the basal chupon and have fruited sooner than a seedling planted at stake would have done. Termites may damage the old roots before the chupon roots can take hold. This has led to many failures. The question of dressings of superphosphate, found successful in Trinidad in greatly increasing yield, is discussed. The equilibrium of Nigerian cacao is very easily disturbed and only small dressings are advisable. Overhead shade is probably desirable. This might prolong the life cycle of the tree. The question then arises whether it would be more economical to grow cacao as a short term rotational crop.

1472. WILBAUY, R. 633.812-1.56

Essais de préparation d'essence de vetiver. Preparation of cuscus essence. Rapport annuel pour l'exercice 1938 de l'Institut national pour l'étude agronomique du Congo Belge [I.N.E.A.C.], part 2, 1939, pp. 54-60.

Cuscus arvensis *Vetiveria zizanioides* Stapf, *Andropogon muricatus* Retz., from the roots of which a perfume is manufactured, grows well at the lower altitudes in parts of the Belgian Congo. Yield records for the country are not available but at the island of Réunion it is 1.400 kg. of dried roots per hectare per annum, if planted at the rate of 20,000 per hectare. The yield from distillation is 1% essential oil from air-dried roots. In Java the yield is 2-3%. The technical and chemical details of distillation are discussed. In some experimental distillations under inconvenient conditions at Yambi (Congo) 1.3%, of essential oil was obtained. The quality was inferior to that processed in Europe, but an analysis of the working expenses indicates that a small profit per hectare should result.

1473. MOLINARY-SALÈS, E., AND JULIÀ, F. 633.815

Yautia. (Tanier.) [Xanthosoma spp.—Ed.] A.R. Puerto Rico Agric. Exp. Sta. 1934-9, 1939, pp. 93-4.

In planting water pieces with stalk attached gave higher yield and higher "germination" than pieces of root. The latter decayed easily in wet weather and were slow in starting growth. In some not very conclusive fertilizer experiments applications of NH_3 appeared to lengthen the period in which tubers were produced.

1474. OZEROV, G. V. 633.88.7-1.8 + 1.415

Fertilizers as promoters of yield in cinchona. C.R. Acad. Sci. U.R.S.S., 1939, 22: 135-8, bibl. 12.

Pot experiments at the Sukhum Introduction Nursery confirm previous experience that the optimum soil reaction for cinchona is slightly alkaline to nearly neutral, ranging from pH 7.3 to 8.0. A reduction of pH to 7.6 resulted in greatly increased total yield and yield of alkaloids. Hence it is found that ammonium sulphate and nitrate slightly inhibit growth in cinchona in slightly acid, argillaceous soil of river alluvium whereas potassium nitrate and potassium phosphate favour growth and alkaloid formation under the same conditions. Part of the high efficiency of potassium salts is probably due to their physiological alkalinity. Physiologically acid fertilizers are bad for cinchona in an acid soil unless preceded by lime owing to deterioration in physical structure and chemical composition of the soil. One and the same fertilizer will differ in effect according not only to soil reaction and form of salt introduced but also to the ratio of nitrogen and phosphoric acid in the soil solution.

- [1475. FLEMING, E. 633.912

Planting material. (Summ.) Ceylon Rubber Res. Scheme, 1940, 17: 142-58.

The history of plant improvement in *Ficus* is related. The respective values are discussed of clonal seedlings of three classes, i.e. illegitimate, isolation garden and legitimate, and budded rubber. No use can be made out for the seedling tree as a plant form intrinsically superior to the budgraft. Recommendations are made for clones for planting in 1940, and notes are given on the peculiarities of those recommended. There is evidence that the potential yield of the stock is positively correlated with the yield of the stool especially in the neighbourhood of the bud union. The differences involved are likely to be commercially significant and the problem of what seed to use for stock is worth consideration.

1476. SCHMIDT, J. F. 633.912

Voorlopige resultaten van een plantverbandproef met oculaties. Density planting trials with budded rubber. (English summary pp. 2.) Arch. Rubbercult. Ned. Indit. 1940, 24: 287-304, being Meded. Proefst. A.V.R.O.S. Rubberstr. 117.

The results of density planting experiments with budded rubber for the first twelve years after planting are discussed. After 7 years of tapping the more densely planted plots (3 x 3 m., 4 x 4 m. and 5 x 5 m.) produced considerably more rubber than the wider spacings, but, especially

in the two closest spacings, bark renewal was so bad as to render certain a sharp fall in yields at a future date. Any reduction in tapping would lose the only advantage of close planting, i.e. high yields per acre. It remains to be seen what changes in these yield relationships occur in course of time.

1477. FERWERDA, F. P. 633.912-1.541.11
Gegevens tot medio 1939 betreffende de toetstuinen voor cloonen en zaaisels
aangelegd in de periode 1926-1932. (Selection results up to 1939 from trial
grounds for rubber clones and seedlings.) [English summary.]
Arch. Rubbercult. Ned. Indië, 1940, 24 : 353-94, bibl. 11.

Chapter I describes method of selection and the layout of the trial grounds. II and III give detailed notes on the various rubber clones and IV sums up the results. The fact that of 265 clones originating from L.C.B. selected mother trees on estate plantations only 6 were found to compare in yield with well known clones demonstrates the difficulty of finding winners by this method, for not 2 per 1,000 of the originally selected mother trees have yielded a useful clone. Further advance seems only possible, if the mother trees chosen among legitimate seedling families are made the starting point for further investigation. Chapter V deals with breeding. The bud grafts of the secondary clones have been made from buds taken from the stems of cross-bred seedlings. They are in appearance very different from ordinary buddings, the stems have a marked conical shape and the stock/bud union is so smooth as to be practically invisible. The name seedling-budding is proposed for this type. These secondary clones yield 25-30% less than the mother seedlings from which they originate, probably because of the method of propagation. The same applies to seedling buddings of illegitimate clonal seedlings.

1478. WHITELAND, E. W. 633.912-1.541.5
Some aspects of budgrafted rubber in Ceylon.
Quart. J. Ceylon Rubb. Res. Scheme, 1940, 17 : 159-74.

Much of the older planted budded rubber (1929-33) is unsatisfactory especially when compared with seedling rubber of similar age. The irregular and backward growth is attributed to (1) insufficient general manuring in the first 3 years; (2) failure to give special manuring to backward plants; (3) use of poor or unsuitable clones; (4) lack of attention to ground conditions; (5) the use of too heavy a stand of *Albizias*; (6) failure to supply vacancies; (7) poor holing and filling; (8) suppression by surrounding old rubber; (9) suppression by continual wind. Each of these headings is subsequently discussed. Other points discussed are budding in the field versus in the nursery, the author being in favour of the former; the maximum altitude at which budded rubber can succeed, 1,000 feet being here considered the limit of safety; bud grafts versus clonal seed; the author, though an advocate of budded rubber, has recently been much impressed with the performance of clonal seed in Ceylon; the trees yielding 1½-2 years earlier and being apparently hardier in difficult situations. Some outstanding clones are discussed. *Pueraria* is regarded as the best reconditioner of soil outside the planting holes, though it may result in some initial retardation of growth. For overhead shade the author prefers *Gliricidia* or dadap. He does not like *Albizia*.

1479. SCHMÖLE, J. F. 633.912-1.541.11
De invloed van den onderstam op de productie van oculaties. (Stock influence
on the yield of bud grafts.) [English summary pp. 1½.]
Arch. Rubbercult. Ned. Indië, 1940, 24 : 305-14, being *Meded. Proefst.*
A.V.R.O.S. Rubberser. 118.

From trials with various stocks planted in 1930 at the Polonia Experimental Garden, Java, the following results are noted. The girth of bud grafts of clone AV 50 on AVROS 163 illegitimate stock exceeds that of the budgrafts of this clone on all other stocks used. The yield of bud grafts of clones AV 49 and AV 50 on AVROS 163 is higher than on any other stock used, that of AV 50 being the higher. In AV 49 the influence of stock on yield is slight, if the distance from the tapping cut to the union of the bud graft is more than 24 inches. If it is less, the influence is much greater. AV 50, even with a high tapping cut, yields 12-30% more on AVROS 163 than on other stocks and AV 49 3-12% more. A few lines on other but less successful stocks for these two scion clones are given.

1480. FERRAND, M. 633.912-1.541.11
 Quelques données sur la croissance et la production des clones de greffes d'hevea. (**Growth and yield of clonal budded *Hevea*.**)
Rapport annuel pour l'exercice 1938 de l'institut national pour l'étude agronomique du Congo Belge [I.N.E.A.C.], part 2, 1939, pp. 72-98.

The paper consists mainly of statistically analysed tables of the performances in growth and yield of various clonal rubber at Ygambi, Belgian Congo.

1481. FERRAND, M. 633.912
 Note sur la sélection de l'hevea en pépinière. (**Nursery selection of *Hevea*.**)
Rapport annuel pour l'exercice 1938 de l'institut national pour l'étude agronomique du Congo Belge [I.N.E.A.C.], part 2, 1939, pp. 99-113.

Cramer's Testatex method of classifying young hevea, i.e. puncturing with an apparatus consisting of 4 V-shaped blades set one below the other on a handle, and classifying the amount of latex flow into 5 categories is compared with the author's own method in which a single sloping cut is made with a grafting knife half way round the tree. Results obtained with each method coincided. In nursery selection by either method the 2 lowest categories can be eliminated (i.e. a white line or a drop of latex without further flow) but a few should be kept for future comparisons. The latex flow of the remaining 3 classes must be carefully watched in as large a number of trees as possible. Attempts are to be made to correlate degree of latex flow with growth or other characters. Another point to be studied is the connection, if any, between vigorous growth of the radicle during germination and vigour of the subsequent plant; if established this would be useful in allowing early selection of plants for rootstocks. Comparative anatomical studies of the bark of young seedlings is needed. Testing of latex flow should be made during the dry season. Apart from selection of useful individuals by these methods a main objective should be to discover whether certain trees consistently produce larger quantities of superior seedling progeny than do others.

1482. DE SARAM, F. 633.912
Modern methods of opening jungle for rubber.
Quart. Circ. Ceylon Rubb. Res. Scheme, 1940, 17: 59-65.
 GWYNN, R. I. M. 633.912
Modern methods of opening jungle for rubber.
Ibidem, 17: 66-70. [Discussion on both papers—pp. 70-7.]

Methods of preparing forest ground for new rubber are discussed chiefly from the point of view of using the natural flora of the country, subject to selective weeding, as cover. Methods of layout and contouring are also discussed. A question debated at some length was whether any or how much burning should be permitted during clearing. Both papers argue against burning. The many advantages and few disadvantages of not burning are summed up in discussion by Mr. R. K. S. Murray, Botanist and Mycologist of the Rubber Research Scheme.

1483. GILLIAT, C. 633.912-1.56
Replanting. Slaughter tapping experiment.
Quart. Circ. Ceylon Rubb. Res. Scheme, 1940, 17: 45-58.

The object of the experiment described was to discover a system of tapping for wet zones during the 12 months immediately prior to felling for replanting which would give the greatest amount of latex in the most economical manner. The age of the trees was 35 years, the bark was rather thin and the depth of tapping seldom exceeded 7-8 mm. The panels were not smooth. Tappers were moved to a different treatment every six weeks. This was necessary since it was found that two particular tappers always managed to produce a slight decrease in yield in every treatment they tapped. There were 8 treatments in all, each replicated 6 times. The highest yield, 49 lb. per acre over all other treatments, and the most economical cost of production were obtained by double three normal tapping for 5 months followed by double two extra deep tapping for 5½ months after one month's rest. The double three system gave the cheapest

tapping throughout. Relative importance of cost of tapping and total crop depend on price of rubber and exportable quota. At present the total crop is much more important than cost of collection. A conclusion reached is that in general trees can be tapped more severely than hitherto thought. Daily tapping and multiple cuts were excluded from the experiment for adequate reasons.

1484. BERTRAND, H. W. R.

633.912-1.543

Costs of replanting.

Quart. J. Ceylon Rubb. Res. Scheme, 1940, 17 : 78-91.

The costs of replanting vary so tremendously in every section of the process and between almost every estate that exact figures are impossible to provide. The author accordingly discusses the subject generally and gives, for what they may be worth, the highest and lowest figures that he has encountered in his enquiry for each section of the work.

1485. MURRAY, R. K. S.

633.912-1.56

Tapping young budded rubber.

Quart. J. Ceylon Rubb. Res. Scheme, 1940, 17 : 175-88.

The purpose of the paper is to afford guidance on the technique in first tapplings of young budded rubber. Evidence is brought to show that tapping at an early age has no adverse after effects. The system in this case was a half spiral on alternate days with winter refoleation rest of one month. The author for want of evidence does not at present claim similar results for other tapping systems. The criterion suggested is a girth of 20 inches, 3 feet above the union, to start when 75% of the trees in a given area have attained this size, but actually no harm would result if a proportion of trees of 18 inch girth were included to bring the tappable trees up to 90%. Anatomical differences between budded and seedling rubber are discussed and their bearing on tapping. The most suitable tapping knife for use up to 36 inches is the Michie-Golledge knife. The absence in budded rubber of the outer corky layer in the basal portion of the seedling stem means that the ordinary dual purpose spout-cum-cup-hanger is unsuitable since it cannot be securely anchored without causing a wound in the wood. A suitable cup-hanger can be made of 12-gauge wire and fastened round the tree with 16-gauge wire. The spouts are made separately of 24-gauge metal cut to two small tongues which prevent them being knocked into the bark more than 4 millimetres. Choice of tapping system depends on the locality and the clone. This question is discussed at some length for some clones available in Ceylon. A bark consumption experiment still in progress shows after 21 months no significant effect on yield of $\frac{1}{2}$, $\frac{3}{4}$ or 1 inch consumption per month. Initial height of cuts for various tapping systems is given. The slope of the cut should be at least 25°. (In Malaya and Dutch East Indies a slope of 30° is usual.) An annual change over of panels is an advantage in providing tappable bark on both sides of the tree if a change from single to double cut system seems desirable later, but the benefits claimed of better bark renewal and higher dry rubber content appear to be illusory. Young trees when first tapped often experience pre-coagulation of latex; this should right itself in a few weeks. If not, ammonia and sodium sulphite are useful anticoagulents. The make-up of the solutions is described.

1486. WHELAN, L. A.

633.912-1.874

The maintenance of soil fertility in young rubber clearings.

Quart. J. Ceylon Rubb. Res. Scheme, 1940, 17 : 92-108.

The manurial requirements of young rubber clearings are discussed and the results of field trials quoted. There have only been small and inconsistent responses to manures when measured 12 months after the first application. No difference in response of young budded rubber to organic or inorganic artificial manure, when the incorporation of green manure was included in both treatments, was shown after 3 years. In general it is recommended that N, P and K should be mixed in the earth of the planting hole. Suggestions are made for effectively safeguarding the fertility of the soil. Cover crops are a benefit but must be controlled and kept from too close contact with the young plant.

1487. HAINES, W. B., AND CROWTHER, E. M. 633.912-1.8
Manuring *Hevea*. III.* Results on young buddings in British Malaya.
Emp. j. exp. Agric., 1940, 8 : 169-84.

The results of fourteen manuring experiments with young budded rubber on the inland soils of British Malaya are described. Phosphate has proved to be the outstanding stimulant of growth, earlier maturity to the extent of between 6 months and 2 years being easily gained when manuring was started in good time. Nitrogen gave much smaller effects and potash normally gave nothing measurable. Interactions between the three elements were not of great importance. The yield comparisons as yet refer only to early tapping years, but effects are signally small compared with the known influences on vigour and growth. [Author's summary.]

1488. SOESMAN, J. G. 633.912-2.69
 Een methode ter bestrijding van hertenplaag in jonge rubbertuinen. (A
method for combating deer in young rubber plantations.)
Bergcultures, 1940, 14 : 664-5.

Various kinds of deer are very troublesome among young rubber in Java which they attack by biting off the top of the growing point. The animal preservation laws prevent any attempt at destruction except during a very limited season. The author has devised an effective plan to keep them away. He hangs on the tree near the shoot a bamboo joint as broad as it is long, capacity about 250 cm.³ and fills it with some evil smelling liquid such as rubber water or better still the serum from the coagulating tanks which is, in addition, sticky. The deer attacking the trees gets this offensive fluid in its mouth or smeared over its face and being essentially a clean animal, after one or two such experiences, learns to leave the trees alone. For large deer a latex cup with a pointed base is balanced on a loop at the end of a projecting wire one or two to each tree. If the deer so much as brushes past the cup falls and it will take it a long time to rid its coat of the smell. For the latex cup solar oil is suggested as a suitable filling. The receptacles, whatever their contents, must be cleared of rain water in wet weather.

1489. LEPA, P. 633.913
Russian experience with rubber plants. [Russian.]
Soc. Agric. Moscow, 1940, No. 1, pp. 86-93.

The comparison of kok-saghyz root and seed yields on plantations in different parts of the U.S.S.R. suggests that the following points are important in the cultivation of this rubber plant:—The soil must be well manured and be of fine structure. For seed sown in autumn the soil should be ploughed 18 cm. deep early in June and be given manure and NPK. This operation is followed by 25 cm. deep ploughing, harrowing, final preparation of the soil for sowing and dressing with fertilizer (NPK). The seed is sown 0.5 to 1 cm. deep, after which the rows are dressed with some compost or peat. The soil preparation for spring sown kok-saghyz consists of clearing and harrowing, ploughing 18 to 25 cm. deep, manuring and dressing with NPK fertilizer. Prior to sowing the soil must for the second time be ploughed and harrowed and given superphosphate. Stratified seed should be used and the rows should be covered with compost or peat. All these operations should be carried out as early as possible. Cultivation between the rows should be frequent.

1490. BARABANOV, P. N. 633.913 : 634.972.2
***Acer platanoides* as a rubber plant.** [Russian.]
Ann. White Russ. agric. Inst. Gorki, 1939, No. 8 (30), pp. 77-8.

Analyses made at the laboratory of the U.S.S.R. Rubber Institute of sap, leaves, seed and shoots of *Acer platanoides* showed that they all contained rubber latex and resins. Most of the latex (1.1%) was found in the sap.

* I. Haines, W. B. and Guest, E. Recent experiments on manuring *Hevea*, and their bearing on estate practice. *Ibidem*, 1936, 4 : 300-24 ; *H.A.*, 6 : 917.

II. Haines, W. B. Manuring *Hevea*. A revision of experimental results by means of a sampling method for yield. *Ibidem*, 1938, 6 : 11-9 ; *H.A.*, 8 : 867.

1491. MILLER, N. C. E.

632.77 : 634.1/7

Fruit flies.*Malay. agric. J.*, 1940, 28 : 112-21, bibl. 1.

The available information as regards four species of fruit fly of Malaya is discussed. Some control can be exercised by means of bait traps, protective coverings to the fruits and by removing and burying or boiling all fallen fruit. If the fruit is buried it must be at least 6 inches deep and the covering soil well tamped down. It is of interest that a bait which attracts the fly in one country may be ineffective with the same species in another. The most effective baits in Malaya were (1) Jarvis bait composed of $\frac{1}{8}$ oz. vanilla essence, $\frac{1}{2}$ oz. Scrubbs ammonia, 26 oz. water; and (2) formaldehyde solution composed of $\frac{1}{8}$ oz. 40% formaldehyde, 13 oz. sugar, 26 oz. water. The traps are glass jars 5 inches wide by 4 inches deep having a piece of tin suspended overhead to exclude rain water.

1492. CRUZ-MONCLOVA, H.

634.441

The mango. Its industrial possibilities : chemical and physical characters.*A.R. Puerto Rico agric. Exp. Stat.* 1937-8, 1938, pp. 28-30.

The notes given here are from a study of the mango fruit of the many varieties found in Puerto Rico. Considerable differences in keeping quality exist between varieties of mango. The keeping quality is related to length of ripening period but may not be the same, e.g. Colombo Kidney keeps for 10 days but ripens in 3 days after picking. Sandersha will keep for 4 days but only 40% will ripen in 3 days after picking, the reason being that some fruits start to decay before complete maturity. The physio-chemical changes in composition which the fruit undergoes at ripening are closely related to physical characters such as colour, lustre, smoothness, hardness. A fully grown Itameraca mango, picked fully grown, has a sugar content of 6.3% and a 1.4% acid content. In 8 days under normal conditions the sugar content will be 14.6% and the acid content 0.2%. Similar changes differing only in degree occur with other varieties. In five days after cutting Champadan mango lost 11.13% of weight at 26° C., but at 9° C. it lost only 3.79% in 5 days and 8.92% in 37 days. These weight losses can be greatly reduced by coating the mango with a very thin film of paraffin wax. Requirements for a canning mango are medium to large size, weight 400-500 grams, as nearly round as possible, small flat seed with a minimum of fibre, hard and firm texture, palatable and of agreeable aroma, colour intense orange yellow, high sugar 10% and acid content 1.1-2.5%, even when not fully ripe, and retaining good qualities after processing. No varieties possess all these characteristics but Concord, Americano and one or two others come near it.

1493. HORN, CH.

634.471

Existence of only one variety of cultivated mangosteen explained by asexually formed "seed".*Science*, 1940, 92 : 237-8, bibl. 10.

The mangosteen (*Garcinia Mangostana*) as known to cultivation would appear to consist of one variety only. In Puerto Rico plants bearing female flowers only are reproduced from seed which develops in the absence of the functional male flower. Male flowers would not appear to have been seen within the last 100 years and all descriptions of them would seem to be based on that given by Roxburgh, probably from herbarium specimens, in *Flora Indica* in 1832. The "seed" formation is asexual and was termed apomixie by Sprecher, *Rev. gen. Bot.*, 1919, 31 : 513-31. As described by him the adventitious embryo that develops to form the seed originates from a cell in the epithelium of the ovary inner integument. The reproduction is thus distinguished from nucellar budding that occurs in apogamic reproduction in citrus and mango. As the cell of the inner integument develops into a papilla and further to form the seed the nucellus and embryo sac become non-functional. Descriptions of mangosteens from Java, Malaya and Trinidad tally exactly with those of Puerto Rico fruits. It would seem therefore that there is only one variety of the cultivated mangosteen. Apart from this, Burbidge in 1887 noted a native form in British North Borneo which was 4-carpellate, each carpel having a well-developed seed, while the cultivated form has 4-8 carpels only 1 or 2 of which develop seeds. Wester also describes the Jolo mangosteen as having a slightly different form, but this may have been due to environment.

1494. VAN DE WEYEN, R. 634.6
 Aperçu sur quelques essais culturaux entrepris à la division du palmier à huile. (**Experiments with oil palms.**)
Rapport annuel pour l'exercice 1938 de l'institut national pour l'étude agronomique du Congo Belge [I.N.E.A.C.], part 2, 1939, pp. 61-71.

Experiments on the oil palm are described.

I. *Preparation of planting holes.* Filling materials used: (a) river silt deposit, (b) mixture of black top and yellow subsoil, (c) alternate layers of river silt and humus with dry leaves, green leaves and wood ashes mixed in; (d) river silt with 3 kg. of lime; all the above left open for one day before planting; (e) partial filling by knocking in the wall of the hole; (f) filling with river silt, the hole wall remaining intact; (e) and (f) were left open 3-4 weeks; (g) organic matter was buried round the palm in semicircular holes situated 4 cm. from the base; depth 65 cm., width 40 cm.; open for 1 day. *Results.* Leaving the holes open too long resulted in hindering growth though less markedly than in 1939. The top and subsoil mixture (b) gave an improvement not observable in 1937. Filling (c) also gave significantly favourable results in 1937 and 1938. The results are judged on weight of bunch per fruiting palm. Treatment (g) appears to be beginning to increase vigour. The action of lime is less marked than in 1937. *Size of planting holes.* Although not statistically significant there is a 20% decrease to record against the smallest planting hole, 35 cm. deep \times 40 cm. across. The other sizes showed no differences probably on account of attacks of *Pimelephila*. No indication is given of the age of the trees.

II. *Preparation and age of planting material.* The factors considered in various combinations were, large or small ball of soil, 3 degrees of vigour of leaves, shade or no shade, age of plant. *Results.* Plants with large ball, planted when 18 months old, gave a higher yield than those planted similarly at 12 and at 6 months; between the two latter there were no differences; economically it pays to plant the smaller sizes. Bare root planting gave lower yields than planting with ball and the older the bare root palm when planted the poorer the results. The favourable influence of a large ball of soil was statistically significant in palms planted at 18 months but not at 12 months. Degrees of leaf vigour showed no differences. The effect of shade is not mentioned.

III. *Interplanting Elaeis and coffee.* Planted 1935. It is too early for definite results, but so far the interplanting of 121 palms + 847 coffee bushes is giving a lower yield (for the palms) than the 121 palms + 550 coffee bushes plots. A plantation of palms with *Pueraria* ground cover and no coffee was inferior to the other treatments which were all clean weeded.

IV. *Artificial manures on adult palms.* Trees planted 1934. Manure applied June and December 1935. None of the fertilizer combinations had any effect, in fact the unmanured controls gave the higher yields. The plots were limed in January 1938, but results here cannot yet be expected.

1495. BUCKLEY, F. E. 634.6
The native oil palm industry and oil palm extension work in Owerri and Calabar Provinces.
Paps. 3rd W. Afr. agric. Conf., 1938 (received 1940), Vol. 1, Nigerian Section, pp. 207-17, bibl. 3.

The paper describes the nature and progress of palm oil extension work in Owerri and Calabar Provinces from 1928 to 1938. This is prefaced with a very interesting account of the native oil palm industry and of the land tenure system as it affects oil palm.

1496. LUCY, A. B. 634.6-1.531
Experiments on the germination of oil palm seeds.
Malay. agric. J., 1940, 28: 151-8, bibl. 2.

The experiments were undertaken at Serdang Experiment Station, Malaya, consequent on a report from an oil palm estate that better germination had been obtained from the seeds sown in specially prepared beds of pericarp residue than from seed sown in sand beds. Hitherto experiments had resulted in the selection of an open sand bed as the best medium. These are expected to give an average germination of 75% in 16 weeks. The new set of experiments now

initiated gave results as follows:—Fresh seed in sand beds is still the most successful, giving 88% germination in 32 weeks. Pericarp residue gave 73%. The non-removal of the pericarp gave unsatisfactory results in either medium. Preliminary submersion of seed in running water for varying periods up to 36 days had no effect on final germination, though for the first few weeks germination seemed to slow down. Equally satisfactory results were obtained by soaking the fruit in water or by paring off the pericarp with knives. Storage up to 12 weeks did not affect viability. Seed cleaned by soaking and stored for varying periods up to 12 weeks gave satisfactory germination.

1497. WILSHAW, R. G. H.

634.6-1.8

Manurial experiments on oil palms.

Malay. agric. J., 1940, 28 : 258-75, bibl. 3.

The results of manurial experiments* with oil palms which have been in progress since 1929 are reported. On quartzite soils phosphate manuring gives economic increase on areas yielding not more than 1,500 lb. of oil per acre per annum. The effect of phosphate on yields does not become evident for 18 months after application and the effects last for about 18 months. There was no evidence that economic increases cannot be obtained with greater dressings of rock phosphate than 4 lb. per palm per annum or that potash is a manurial requirement. On young palms economic increases have been obtained by manuring with complete NPK or with NP mixtures. There is no reliable result for peat soils other than that published in the first paper of the series, which is the same as that given here for quartzite soils. No beneficial effects on peat soils were obtained by liming up to 2 tons per acre. The effects of potash and nitrogen on peat soils are unknown but are under investigation. Experiments on other soil types are in progress.

1498. LUCY, A. B.

634.6-1.874

A comparison between natural covers and clean-weeding on yields of oil palms.

Malay. agric. J., 1940, 28 : 159-63, bibl. 2.

The object of the experiment was to compare the effect on yield of fruit bunches of oil palms of (a) clean-weeding, (b) slashing the natural undergrowth to the ground three times a year and (c) the forestry method in which selected natural undergrowth is periodically cut back to 4-5 ft. Yields were unaffected the first year. During the second year (a) gave an increase of 19% while (c) gave a decrease of 11% compared with slashing. In the third year the yields from the clean-weeded plots were 26% greater and those from the forestry plots 14% less, than those from slashing.

1499. SILVA, R. F. E.

634.61

O coqueiro anão. (The dwarf coconut palm.)

Publ. Minist. Agric. Brasil, 1939, pp. 11.

The dwarf coconut was introduced into Brazil in 1924 by the then Minister of Agriculture and is now distributed in small numbers more or less throughout the coconut districts of Brazil. There are three varieties known from the colour of the leaf stalks as ivory yellow, green and red. These are described. In starting a plantation seed must be obtained from a reliable source, otherwise mongrel plants from natural crossing with the common coconut may result. Optimum conditions are a deep soil well supplied with organic matter and the elements of plant nutrition, especially potash, a mean temperature of 25°-27° C., altitude up to 800 metres, sufficient moisture, wide exposure, full sunlight. In the matter of altitude 800 metres is regarded as extreme; it can be accepted that the higher the altitude the smaller the crop. Cultivation does not differ from that of the ordinary coconut. Manuring is advisable. Fruiting begins at 3 and sometimes at 2 years of age. Yield of adult trees may be anything from 25 to 300 nuts a year, but in Brazil about 60 is the average. Photographs are given showing some very heavily laden 3-year-old trees. Some (undated) comparisons between dwarf and tall coconuts are culled from a periodical the name of which as transcribed it is impossible to recognize, but may possibly be the Agricultural Journal of Malaya (unless there really is one called "The Kuola Kumpur").

* Previous reports *Malay. agric. J.*, 1935, 23 : 321-5; 1937, 25 : 286-96; 1938, 26 : 273-81; *H.A.*, 5 : 486; 7 : 1044; 9 : 287.

The comparisons are throughout favourable to the dwarf coconut for yield of nuts and copra. The bulletin concludes with an estimate of the cost of the first 2 years of establishing and running a new plantation of dwarf coconuts.

1500. SALGADO, M. L. M.

634.61-1.8

Manuring of young palms.

Leaflet. Coconut Res. Scheme, Ceylon, 8, 1940, pp. 6.

Provisional recommendations for young coconut palms from the seedling transplantation to the bearing stage are made pending results from two experiments recently laid down by the Coconut Research Scheme. Past experiments, though of an antiquated type, and general observations have shown that potash is a predominant requirement, also that by suitable manurial treatment palms can be brought into bearing as early as the 4th or 5th years. At transplanting the holes should be filled with good top soil mixed with 2 kerosene tins of wood ashes or 2-4 lb. of husk ash or $1\frac{1}{2}$ -2 lb. of muriate of potash. On poor soils 2 basketfuls of well-rotted cattle manure may be added. Further manuring is unnecessary until the end of the second year from planting. The mixture then recommended is (a) sulphate of ammonia or calcium cyanamide 2 parts, saphos phosphate 2 parts, muriate of potash 3 parts or (b) in the event of a wartime shortage of sulphate of ammonia or its equivalents a reduction of these to 1 part and the substitution of 3 parts of ground nut cake. These mixtures are applied as follows: 2nd year (to supplies and underplanted palms only) (a) $1\frac{3}{4}$ lb. per tree or (b) [alternative] $2\frac{1}{4}$ lb.; 3rd year (to all young palms) (a) $2\frac{1}{2}$ lb. or (b) 3 lb.; 4th year (a) 3 lb. or (b) 4 lb.; 5th year and until bearing (a) 4 lb. or (b) 5 lb. Until the stem is formed the manures are applied close to the tree, from then until bearing in a circular trench 2 feet wide, 2 feet from the palm, while at bearing the trench is cut 3 feet wide at 3 feet from the palm. Young palms are very susceptible to drought. Much good is done in these conditions by mulching with coconut husks or coir dust. In the case of the latter an area of 6 inches should be left bare round the base of the young palms as coir dust in contact with the young leaf bases tends to cause rot.

1501. DWYER, R. E. P.

634.61-2.19-1.4

Some investigations on coconut diseases associated with soil conditions in New Guinea.

N. Guinea agric. Gaz., 1939, 5: 3: 31-53 and 1940, 6: 1: 2-37, bibl. 34.

An account is presented of some further investigations* on physiological disorders (die-back, wilts, etc.) of coconut palms in New Guinea. Special attention is paid to maturation wilts of young coconut palms at first bearing stage. Maturation wilt is probably a physiological disease associated with unfavourable (dry) weather conditions. Some pathological derangements of mature palms ("mature palm wilts") are described, as are the contributory causes. The probable reasons for the relatively infrequent occurrence of severe wilts, even in districts where palms grow poorly, are discussed. The occurrences in New Guinea are compared with similar diseases recorded from other countries. The symptoms displayed are of physiological origin with the exception of a possible virus disease. The chemical and physiological changes (especially as regards moisture requirements and potash movements) which occur in coconut palms at various stages of growth are discussed in relation to the diseases described. Particular attention is paid to the physiology of the root system and its natural adaptations and reactions to such unfavourable circumstances as water-logging and lack of aeration. Other diseases discussed as being primarily associated with unfavourable environment including adverse nutritional relationship are seasonal bearing, leaf droop, frond choke, certain types of nut-fall, bud collapse, deficiency spotting and die-back. Selected soil profiles showing various unsuitable conditions are described both in relation to diseases present and their control. The relative importance of physiological disorder of coconut palms as related to fungus diseases or as distinct from virus diseases is not yet determined. There is need for chemical and botanical research on the nutrition of the coconut palm in relation to the soil conditions obtaining in New Guinea.

* Previous paper Dwyer, R. E. P. The diseases of coconuts (*Cocos nucifera*) in New Guinea. *Ibidem*, 1937, 3: 1: 28-93; *H.A.*, 8: 260.

1502. O'CONNOR, B. A. 634.61-2.754
Control of coconut treehoppers (*Sexava* spp.) by dusting.
N. Guinea agric. Gaz., 1940, 6 : 1 : 38-43.

Treehoppers (*Sexava* spp.) in New Guinea coconut plantations can be controlled by dusting with calcium arsenate at the rate of 12 lb. to the acre. The cost of material for two dustings is about 9s. per acre and total costs should not exceed 11s. Figures are given to enable the planter to calculate whether dusting is an economic proposition in his particular case. For instance with copra at £5 per ton on the beach it might not be worth while, but at £10 it would.

1503. TEIK, G. L. 634.61-2.954
The effect of sodium arsenite applied to control weed-growth among coconut palms.
Malay. agric. J., 1940, 28 : 177-8.

Experiments were carried out at Serdang Experiment Station, Malaya, which concern sodium arsenite used as a weed killer under coconut. The rate of application was 121 lb. to the acre. The treated palms remained outwardly unaffected. The grass had re-grown after 3-6 months, thus showing that there was no permanent toxic effect on the soil. The amount of arsenious oxide found in the two nuts examined, 0.0004 and 0.00006% respectively, would require the consumption of at least 1,400 nuts by one adult to produce fatal results (from the arsenic).

1504. WOLCOT, G. N. 634.651-2.752
The papaya scale controlled by spraying with water.
A.R. Puerto Rico agric. Exp. Stat. 1937-8, 1938, pp. 36-7.

Spraying papaya trees infested with scale (*Pseudoparlatoria ostreata* Cockerell) with water at 300 lb. pressure removed the scale without difficulty and more efficiently than treatment with insecticides. Should fresh infestations develop, it is only necessary to repeat the pressure treatment.

1505. URQUHART, D. H. 634.771
Notes on the banana industry in the British Mandated Territory of the Cameroons.
Paps. 3rd W. Afr. agric. Conf., 1938 (received 1940), Vol. I, *Nigerian Section*, pp. 173-83.

The history of the building up of the banana industry in the Cameroons is recounted. Soil conditions are described. A high acidity does not affect the plants adversely but good drainage is essential and stagnant water most deleterious. It is estimated that bananas can occupy the better soils in this district for 12-15 years without manuring. A common practice is to maintain trenches 18" wide and 2' deep between the rows and to throw in all vegetable refuse which includes the bananas often rejected by the shipping company through lack of space. A well run plantation should produce 77% of 9 hand bunches at any rate for the first 5 years. Any heavy reduction such as may occur after the 7th year indicates the need of manure. Bananas rejected by the shipping companies are unsuitable for the dried banana trade as they are insufficiently developed. Cacao is sometimes interplanted for subsequent use should the bananas eventually fail. The cost of production is analysed. The profit should be about £12 per acre or 1s. per bunch. The shipping companies pay 2s. per bunch of 9 hands.

1506. CIFERRI, R. 634.771
 Identificazione e caratteristiche delle razze di banano coltivate nella Somalia italiana. (**Identification and characters of banana strains cultivated in Italian Somaliland.**) [Brief English and Latin summaries.]
Atti. Ist. bot. Univ. Pavia, 1938, 10 : 73-123, bibl. 59.

Two climatic conditions in Italian Somaliland militate against successful banana growing, namely, a periodical hot dry monsoon wind and the lack of irrigation throughout the year. The only banana which is grown on a commercial scale, the "Giuba", appears to be a typical

Musa nana (= *M. Cavendishii*), nearly allied, if not identical to the Lacatan banana. Notes are given both of this and of a large number of other strains also found.

1507. BARNELL, H. R.

634.771 : 613.2

The banana in relation to human nutrition.

Trop. Agriculture, Trin., 1940, 17 : 143-6, bibl. 25.

The world production of bananas for overseas export in 1937 was more than 2½ million tons of which the U.K. took 329,000 tons. Considerable technical skill is needed to deliver the banana in edible condition at the shop of the retailer in Europe. This is due to difficulty in controlling ripening while preventing chilling. A chilled banana is unpalatable and indigestible. Recent experiments at the Low Temperature Research Station, Trinidad, have shown, however, that refrigerated gas storage of banana will considerably retard ripening without affecting quality or the carbohydrate composition. There are as yet no data on the possible effects on the vitamin content. The analysis of what represents quality in fruit presents many complexities and is still unsolved though under active investigation. Loss of quality in transit is caused by premature ripening during cold storage with the appearance of chilling symptoms and to a lesser extent from *Cercospora* infection, both of which produce a slightly astringent taste. Fruit subjected to gas storage after incipient ripening has already taken place are also of poor quality. A table is given showing the composition of normal and of chilled bananas when eating ripe. Nutritionally the banana is a rich source of energy ranking higher than the potato, but it is unsuitable as a sole source of food because of its relatively low protein and fat content. Twenty-four bananas per day with the addition of milk provide a balanced ration for an adult performing no manual labour. The banana contains vitamins A, B₁, B₂ (or G) and C in reasonable quantities, D and E in small amounts only. The often supposed indigestibility of the banana is shown to be a myth; in some cases of chronic indigestion ripe bananas have been the only form of carbohydrate that could be tolerated. The mineral salts potash, phosphorus, calcium and iron are present in greater amounts than in apple or orange. All the iron in the banana is completely available and can be used as a source of haemoglobin.

1508. GIBBERD, A. V.

634.774 + 664.85.774

Pineapple cultivation and low temperature storage investigations (Nigeria).

Paps. 3rd W. Afr. agric. Conf., 1938 (received 1940), Vol. I, *Nigerian Section*, pp. 37-45.

Pineapples have been grown for 30 years in Nigeria, cultivation centering on the variety Smooth Cayenne. Recently studies in the cold storage requirements of these pines have been in progress. Influence of local seasonal conditions on planting and fruiting times are mentioned. For convenience in handling and because of the shorter time they take to fruit stem suckers are used for propagation. They should be taken when about 30 inches long which results in maturity in 12-18 months. Fruiting is retarded if the suckers are much shorter. At 40 inches maturity may arrive in 3-6 months but the fruit will be inedible. No advantages have been gained from wilting the suckers before planting. 6 inches is a satisfactory planting depth. The planting distance producing the heaviest fruit is double rows 5 ft. apart, the plants staggered and with reasonable room for development in the row. Spacing at 18 inches reduces the maturity period to 6-9 months but the mean weight of the fruit is also reduced to 5.3 lb. from 16.7 lb. at 5 ft. Wide spacing favours profuse sucker formation. Vegetative vigour is reduced with the reduction of planting space. Flat planting is preferred to ridging as providing better anchorage; there are no appreciable differences in growth. Heavy shade results in acid fruit of good texture, no shade in excessively sweet and watery fruit. Experiments are in progress to determine the optimum. Various types of defective fruit, pests and diseases are touched on. Storage tests indicate that best results for export are obtained when the fruit is harvested one week before maturity and conveyed at a constant temperature of 50° F. A physiological breakdown often occurs in stored plants during the dry season February and March. The origins of this have been traced to the plant in the field. It is undetectable without opening the plant and a proportion therefore has to be examined. Incipient signs mean that the whole consignment has to be suspended to avoid risk of heavy wastage on arrival. Work on this disease lies in the direction of selection of resistant strains, manurial treatment, shading, mulching and irrigation.

1509. BARTLETT, K. A. 632.752 : 632.96 : 634.774
Introduction and colonization of 2 parasites of the pineapple mealybug of Puerto Rico.
J. Dep. agric. Puerto Rico, 1939, 23 : 67-72, bibl. 2.

The pineapple mealybug, *Pseudococcus brevipes* Ckll. is the most serious insect pest of pineapples in Puerto Rico, attacking all parts of the plant of all the varieties grown in the island. The mealybug secretes a toxin into the pineapple plant which causes a wilted, flaccid appearance varying in degree with the variety of pineapple. The paper records the introduction, rearing, colonization and recovery of the parasites *Anagyrus coccidivorus* Doz. and *Hambletonia pseudococcina*.

1510. STOCKDALE, F. 631.459
Soil conservation in the tropics.

Tea Quart., 1940, 13 : 85-96, reprinted from the "Agricultural Periodical" of the Netherlands Society for Scientific Agriculture, vol. 51, 1939.

A copy of a paper read by Sir Frank Stockdale at the Conference on Tropical Agriculture, Wageningen, Holland.

- HARDY, F. 631.459
Land movements : their classification and relationships to soil erosion.
Trop. Agriculture, Trin., 1940, 17 : 187-92.

- OLIVEIRA, J. M. 632.651.3
Plant-parasitic and free-living nematodes in Hawaii.

Occ. Pap. Bishop Mus., Honolulu, 1940, 15 : 361-73, bibl. 54.

- LINFORD, M. B., AND YAP, F. 632.651.3
Some host plants of the reniform nematode in Hawaii.
Proc. helminth. Soc. Washington, 1940, 7 : 42-4, bibl. 2.

STORAGE.*

1511. ARNOLD, E. L. 664.85.037
Farm refrigerated storages.

Bull. Cornell agric. Exp. Stat. 724, 1939, pp. 39.

An account of the building, adaptation thereof, equipment, etc., necessary for the setting up of a cold store on the farm. The advantages and disadvantages of different materials and different source of power and of cold are discussed.

1512. TRESSLER, D. K., AND DU BOIS, C. W. 664.84.037 + 664.85.037
Freezing and storage of foods in freezing cabinets and locker plants.

Bull. N. York agric. Exp. Stat. Geneva 690, 1940, pp. 60.

This bulletin deals with the preparation for and freezing of both meat and vegetable products. As regards the suitability of particular fruits, apples, blueberries, cherries, currants, gooseberries, peaches, raspberries and strawberries are particularly suitable. Plums and prunes, if properly selected, give fair products. Blackberries, grapes and pears are not generally satisfactory. As regards vegetables those ordinarily eaten raw are not usually such good subjects for freezing, e.g. lettuce, romaine, cabbage, celery, tomatoes, cucumbers, water melon, onions, musk melons, radishes, endive, watercress and chives. The following, which are usually cooked, freeze excellently :—asparagus, snapbeans, green shell beans, lima beans, beets, beet greens, broccoli, carrots, cauliflower, kale, kohlrabi, parsnips, peas, spinach, squash, sweet corn, Swiss chard and turnips. Notes are given as to the particular varieties of the different fruits and vegetables which react best and of the best way of preparing and freezing them.

1513. FISHER, D. V., AND BRITTON, J. E. 664.85.25
Maturity and storage studies with peaches.
Sci. Agric., 1940, 21 : 1-17, bibl. 19.

Results of experiments with yellow-fleshed peaches such as J. H. Hale, Rochester, Vedette and Valiant at Summerland, B.C., during the last five years are here given. Fruit shape and skin

* See also 1508.

colour associated with flesh colour and firmness proved reliable indices of maturity. The optima for these were discovered and are here given. Increase in soluble solids as measured by the Zeiss refractometer was not found to be a satisfactory maturity index. A "mealiness" breakdown limited the cold storage life of peaches, occurring more slowly in early than in late varieties. It became apparent after removal to the ripening room at 65° F. after 1 to 2 weeks' storage at 40° F. and after 2 to 3 weeks' storage at 32° F. With most varieties development of mealiness was greatly retarded by a delay at 75° F. for 1 or 2 days before storage. This delay did not appreciably diminish post-storage life of the peaches and the quality, texture and juiciness in all varieties were improved by delayed as compared with immediate cold storage. Fruit stored at 32° F. remained in good condition only slightly longer in the ripening room than that stored at 40° F. Peaches held at 65° F. from time of picking kept in good condition from 10 to 19 days when mature and from 13 to 31 days when medium mature. Attempts to gas store peaches were discouraging. The packer is advised, when possible, to move peaches rapidly into consumption without cold storing. Varieties such as Elberta and J. H. Hale remain in good condition longer when held at 60° or 70° F. than when cold stored. Earlier varieties can be safely stored at 32° F. for 3 weeks or at 40° F. for 2 weeks, if subjected to a temperature of 75° for 2 days before being stored.

1514. PHILLIPS, W. R.

664.85.035.1

Gas storage [of fruit].

Publ. Dep. Agric. Canada 670, 1939, pp. 10, being *Circ.* 149.

After discussing the principles involved in the gas storage of fruit the author gives a full account of the building and operation of a gas store destined for the storing of apples and pears. Low temperature disorders in apples in ordinary cold store can be eliminated and storage life increased by gas storing at a slightly higher temperature. Moreover fruit properly stored in a suitable gas mixture has a higher quality than fruit stored normally since the natural flavour is more fully retained. Shrinkage also is controlled, resulting in a crisper and fresher looking fruit. Since, however, without ventilation the CO₂ content of a gas store will become excessive and brown heart result, ventilation is necessary. The optimum CO₂ content differs with variety and with maturity and these need to be determined for each variety. In Canada the ground colour test has proved the best for ensuring optimum maturity. After picking the apples should be packed and graded. A mineral oil paper wrap to prevent superficial scald is recommended. They should then be stored without delay. The construction and operation of a gas store at Ottawa is described, details being given of the following steps:—preparation of floors, walls and ceiling; sealing the door; installation of electrical, gas tube connections, etc.; ventilation equipment; methods of gas analysis by the Orsat outfit; operation of the store. Diagrams and full descriptions are given for testing and ventilating a gas chamber.

1515. HARDY, J. K., AND HALES, K. C.

664.85.035.1

Use of lime in "scrubbers": removal of carbon dioxide in the gas storage of fruit.

Reprinted from *Mod. Refrig.*, May 16, 1940, pp. 2, bibl. 2.

The authors describe the successful use of lime in place of caustic soda for the removal of CO₂ in the gas storage of fruit. The difficulties previously present in lime scrubbers have been eliminated by the omission of any kind of packing from the scrubber and by the substitution of a rubber-flap valve for the diffuser plate at the bottom of the inlet pipe.

1516. FISHER, D. V., AND BRITTON, J. E.

664.85.11.038

Apple waxing experiments.

Sci. Agric., 1940, 21: 70-9, bibl. 7.

The authors in their three-year experiments at Summerland, B.C., used wax consisting chiefly of carnauba and paraffin, M.P. 130° F., plus an emulsifier. The wax was applied by dipping the fruit into a warm emulsion at 105° F. and then drying on newspapers. It was waxed within 2 days of picking and wrapped and cold stored within 24 hours of waxing. The cold store temperature was 32° F. and the heat of the ripening room 65° F. Relative humidity was varied in both cases. The apples were of the following varieties:—Delicious, McIntosh, Jonathan, Rome Beauty, Stayman and Winesap. Waxing materially reduced shrinkage of apples held

at room temperature under conditions of low humidity, but not under high humidity conditions. In fact, humidity was a more potent factor in regulating loss of moisture than waxing. Waxing reduced respiration of fruit by about 14% on the average. In some seasons it markedly prolonged the saleable period of McIntosh and Delicious apples after removal from cold store. It delayed the onset of meakiness in Delicious, reduced core-flush in McIntosh and reduced Jonathan spot on Jonathan. It induced a form of scald on McIntosh and Delicious, which may possibly be controllable by oiled wraps. It did not appreciably affect flavour.

1517. PENTZER, W. T., WIAIT, J. S., AND MACGILLIVRAY, J. H. 664.84.61.037
Market quality and condition of California cantaloups as influenced by maturity, handling and precooling.
Tech. Bull. U.S. Dep. Agric. **730**, 1940, pp. 73, bibl. 22, 15 cents.

A very detailed account of exact tests on the result of transport of melons from California and Arizona to the eastern markets. The test lots were made up of several crates of melons, of each of the maturities, varieties or treatments under test or, where precooling and transit refrigeration was the problem, melons alike in maturity, variety and treatment were shipped with and without precooling. In general it may be said that precooling proved advantageous, and that wax treatment had no apparent effect on retarding ripening during transit and marketing. Fumigation with nitrogen trichloride in concentrations of from 4.8 to 33 mg. per cubic foot of air space did not cause injury to or impair the flavour of melons.

1518. BIALE, J. B. 664.85.334 : 632.4
Effect of emanations from several species of fungi on respiration and color development of citrus fruits.
Science, 1940, **91** : 458-9.

Much increased CO₂ evolution and rapid yellowing of green lemons followed the exposure of the fruits to emanations of green mould, *Penicillium digitatum*. Emanations from blue mould, *P. italicum*, had very much less effect and those from *Oospora* and *Alternaria* nil. Shedding of stem ends was caused by green mould only.

1519. POLLACCI, G., CIFERRI, R., AND GALLOTTI, M. 664.85.771 : 632.4
 Lo zolfo colloidale come preventivo contro le alterazioni dei caschi di banana.
 (Colloidal sulphur for the control of infections of banana bunches.) [Brief English and Latin summaries.]
Atti. Ist. bot. Univ. Pavia, 1938, **10** : 257-64.

Tests were made in the laboratory or before shipment of the control afforded by calcium oxide or hydroxide, Caffaro powder, bordeaux mixture and colloidal sulphur. Artificial inoculations had previously been made with *Gloeosporium Musarum*. The prevention of wastage was best prevented by submerging the bunch in a suspension (10 kg. per 100 litres) of colloidal sulphur for a few seconds and following this by a local application of undiluted colloidal paste to the cut end of the main stalk. This treatment was successfully applied to a thousand quintals of bunches.

1520. SMITH, W. H. 664.84.35
The storage of broccoli and cauliflower.
J. Pomol., 1940, **18** : 287-93.

Experiments at the Ditton Laboratory show that cauliflower and broccoli behave similarly in storage. A temperature of 32° F. was better than a higher one for storing in air or gas. A relative humidity of 95% was found best. A storage life of 4-5 weeks was obtained by storing at 32° F. in 10% CO₂ + 11% O₂ + 79% N, leaving a margin of 3-4 days in which the broccoli remained marketable after removal from store. In air at 32° F. a life of about 3 weeks was obtained.

1521. MAYFIELD, H. L., AND RICHARDSON, J. E. 577.16 : 664.84.34 + 664.84.25
The effect of winter storage on the vitamin content of cabbage and onions.
Bull. Mont. agric. Exp. Stat. **379**, 1940, pp. 12, bibl. 18.

Winter storage of Danish Ballhead cabbage for 6 months in a cellar with a slightly varying temperature of about 45° F. and relative humidity of 55% resulted in a loss of about 25% of

vitamin C content, but of very little vitamin B₁ content. Cooking either the stored or fresh cabbage resulted in losses of 25% or more vitamin B₁, and of 40-50% vitamin C. Despite this, fresh or stored, raw or cooked, cabbage proved a good source of vitamin B, and an excellent source of vitamin C. Onions stored similarly lost neither vitamin in the process. Cooking in their case did not affect vitamin B₁ content but did reduce vitamin C content by 50%. Onions were found to be only fair sources of both vitamins B₁ and C.

1522. BROEKEMA, C. 664.84.25

Onion trials 1938. [Dutch, English summary.]

Report of the State Institute for Plant Breeding, Wageningen, 39 '153 (stencilled), 1939, pp. 5.

Details of storage experiments with onions in Holland in 1938. The keeping qualities of different onion selections are compared with those of the standard variety Perijka.

1523. PLATENIUS, H. 664.84.038

Wax emulsion for vegetables.

Bull. Cornell. agric. Exp. Stat. 723, 1939, pp. 43, bibl. 6.

The author notes methods previously in use for waxing fruit and vegetables such as the so-called "Canadian process" for rutabagas, the Brogdex process commonly used in the citrus industry of California, the "slab-wax" method and their modifications. The wax emulsions used in these experiments were proprietary articles consisting of different combinations of substances mainly under the trade name of Brytene, though Brogdex wax and Dowax were also included in the list of waxes tried. Essentially they are all colloidal suspensions of one or several kinds of wax in water and the minute wax particles are kept in the dispersed phase by means of a soap. The response of different vegetables to waxing as determined by percentage of shrinkage in waxed and unwaxed vegetables and by the percentage of reduction in shrinkage due to treatment is shown in tabular form. Technical problems of waxing and drying are discussed and a description is given of a mechanical waxer and drier. As a result waxing can be recommended for first class vegetables of certain types, grown on a large scale in regions far removed from the chief market. It was found excellent for all root crops except parsnips, especially for carrots and cucumbers. Other crops which can be waxed with advantage under commercial conditions are asparagus, immature summer squash, winter squash and pumpkins held in store, husked sweet corn, eggplants, peppers and tomatoes. The waxing of leafy vegetables or bunched root crops has always given unfavourable results.

1524. LOPEZ, D. R. 664.84.9.037

Conservación de flores en cámara fría. (Preservation of flowers by cold storage.)

Reprinted Rev. Fac. agron. Montevideo, 1939, No. 18, pp. 22.

The author reports single experiments in which the effect of cold storing at temperatures ranging from 4.5 to 1.0° C. was noted on the following flowers:—freelias, eschscholtzias, sweet peas, roses, stocks, gladioli and carnations. The treatment was further varied by storing some in water, some in water with the addition of vegetable carbon, and others in damp moss in boxes. Observations which are tabulated show that in all cases considerable improvement was achieved as compared with the results of room storage. It is pointed out, however, that the trials should be regarded only as a guide and repetition is needed before definite rules can be laid down.

PROCESSING AND PLANT PRODUCTS.

1525. HIRST, F., AND ADAM, W. B. 664.85.036.5 + 664.84.036.5

The drained weight of English canned fruits and vegetables II.

A.R. Fruit Veg. Pres. Res. Stat. Campden for 1939, 1940, pp. 16-27, bibl. 4.

Experimental evidence and statistics are given showing the drained weights of more than 6,000 cans of National Mark fruits and nearly 2,000 cans of National Mark vegetables. The tentative suggestion is made that as regards standards for minimum filling weights, these might be raised slightly for most canned fruits, but should remain unaltered for vegetables. There would,

moreover, appear to be no reason against a preliminary investigation into the possibility of establishing minimum standard weights of English canned fruits and vegetables.

1526. HIRST, F., AND ADAM, W. B. 664.85.036.5

Recent advances in the study of hydrogen swells.*

A.R. Fruit Veg. Pres. Res. Stat. Campden for 1939, 1940, pp. 28-37, bibl. 6.

Work by Hoar, Morris and Adam* indicates that steel showing a copper content of from 0.16 to 0.22% and a phosphorus content of <0.04% is the best material for the tinplate to be used in lacquered fruit packs. Lacquer protection is found to be very advantageous. Large scale production of flush lacquered cans has already been achieved. Such lacquering provides almost complete protection against hydrogen swells for about 3 years under normal storage conditions and virtually eliminates the ugly blue discoloration of red or purple fruits. It is also noted that thorough washing of any fruit which has previously been treated with sulphur compounds and the use of sugar of low sulphur dioxide content are great safeguards against future hydrogen swells.

1527. HORNER, G. 664.85.036.5 : 546.22

The behaviour of traces of sulphur in canned fruit.

A.R. Fruit Veg. Pres. Res. Stat. Campden for 1939, 1940, pp. 45-8, bibl. 1.

Experiments to determine methods of detecting the source and amount of sulphur contamination in canned fruit show that deductions on the quantity of sulphur originally present can be made only with great caution.

1528. HIRST, F., AND ADAM, W. B. 664.85.22.036.5 + 634.22 : 632.19

Fruit gumming of Victoria plums. Progress report II.†

A.R. Fruit Veg. Pres. Res. Stat. Campden for 1939, 1940, pp. 38-44, bibl. 1.

The authors note that their results to date do not so much reveal the causes of gumming as indicate lines of future work on the subject. They report as follows:—In the present tests it was noted that there was no significant difference between the plums grown on light and heavy soils, both as regards external and internal gum. On the whole there was less gum where the crops were heavy and the fruit small. The percentage of surface gum fell as the fruit ripened, but the early-ripening fruits actually carried more gum than the underripe fruits. The gumming was distributed unevenly over the trees, and differed appreciably on neighbouring trees. Nearly all the gumming was on the distal end of the plums.

1529. ADAM, W. B. 664.84.036.5

Hydrogen ion concentration of canned vegetables. Progress report.

A.R. Fruit Veg. Pres. Res. Stat. Campden for 1939, 1940, pp. 49-54, bibl. 2.

A preliminary study has shown that the pH value of any given size of immature peas does not alter appreciably during the later stages of ripening, but that the smaller sizes tend to have lower pH values than the larger grades. The pH value of harvested peas is not affected by the stage of maturity at which they cut. There is a fall in pH value of the covering liquid during processing, but, in the case of peas and beans, this later rises as buffering substances are extracted. Averages and ranges of final pH values are given for all the principal English canned vegetables. [Author's summary.]

1530. SPIEGELBURG, C. H. 664.85.774.036.5 : 632.42

***Clostridium pasteurianum* associated with spoilage of an acid canned fruit.**

Food Res., 1940, 5: 115-30, bibl. 28.

Morphological and physiological characteristics are presented for saccharolytic butyric anaerobes isolated from bursting swells of canned pineapple. The two types studied are regarded as smooth and rough strains of one species, *Clostridium pasteurianum* Winogradsky. [Author's summary.]

* See also *H.A.*, 10: 756.

† For I see *H.A.*, 8: 1316.

1531. L'OFFICE FÉDÉRAL DE GUERRE POUR L'ALIMENTATION (SUISSE).

664.85.047 + 664.84.047

Le séchage des fruits et des légumes et l'emploi des produits séchés. (**Drying fruit and vegetables and the use of the dried products.**)

Rev. hort. suisse, 1940, 13 : 202-7.

This article is addressed to the housewife or groups thereof such as Women's Institutes and is a plea that no good fruit or vegetables shall be allowed to go to waste. It is, however, specially noted that drying is not a method of treating waste material and only sound materials should be so treated. After a brief discussion of the main considerations on which drying operations should be based detailed attention is given to the drying of individual fruits and vegetables. Apples and pears are first considered in detail and then cherries and plums. As regards apples it is noted that firm-fleshed apples give a better product than soft and that white-fleshed are preferable to yellow-fleshed, the latter tending to go dark. The apples are peeled and cut into 4 or 8 divisions or into rounds. They are then dried in a special or baker's oven. The temperature should be 80° C. at the beginning of the operation falling to 60-70° C. at the end. The operation will last from 6-48 hours according to utensils, size of pieces, etc. The return will be 10-15% of the fresh fruit. Instructions are given also for the drying of most of the common vegetables and of garden herbs. The products should keep for 1 to 2 years. The vegetables, pome fruits and herbs should be hung in sacks in a well aerated dry place and should be shaken from time to time. They should be kept out of the light to preserve their colour. Vegetables and plants dried without having previously been part cooked are liable to slight fermentation. Directly this is over they should be kept in receptacles closed to the air. Stone fruits and berries should be kept in boxes and should be well aired on sunny days. Green jars with wide necks are particularly suitable for storing dried products. Two pages are devoted to recipes for using the dried products.

1532. ORTON, E. C.

634.873.2-1.56

Vine ash in dipping sultanas.

J. Coun. sci. indust. Res. Aust., 1940, 13 : 181-2.

Imported potash having temporarily become scarce it has been found that the potash obtained from slowly burned vine ash will do almost as well for dipping sultanas as regards drying rate and quality of fruit. On the assumption that there are 480 vines per acre it should be possible to extract the equivalent of 17-22 lb. potash from the weight of prunings. This should more than suffice to temperature dip the whole crop and be enough to cold dip most of it. The canes must be burned at as low a temperature as possible in order to prevent the formation of clinker. When cool the ash should be bagged and stored. One satisfactory method of extracting the ash is as follows:—(1) Fill a tank $\frac{1}{3}$ - $\frac{1}{2}$ full of ash and nearly fill with water. (2) Stir well, leave an hour or more, stir again, leave overnight. (3) Syphon off clear liquid. (4) Refill with water, stir well, leave to clear, syphon off. (5) Repeat operation till Baumé of liquid syphoned off is less than 1°. Three extractions are generally necessary. The first two extracts can usually be combined and adjusted to the desired Baumé, say 3°.

1533. CHASSANT, M.

634.85.8.035.5

Gelée de raisin. (**Grape jelly.**)

Progr. agric. vitic., 1940, 113 : 473-9.

A plea for the use of surplus grapes in making grape jelly or grape and apple jelly without the addition of sugar. The product is said to be extremely palatable and easy to make. Briefly the process is as follows:—(1) The juice is allowed to flow from the press into a recipient where, (a) wholly or partially to remove the acidity successive doses of carbonate of lime are added, stirring meantime to allow the CO₂ to escape; (b) SO₂ is introduced in the usual way to prevent fermentation. (2) The juice, which will then have become clear, is decanted at the end of 24 hours, the valuable residue rich in tartrate of lime being kept. (3) The clear juice is concentrated, this process being carried out till the remaining liquid contains 70-71% sugar. (4) The concentrate is taken to the boil for a few moments and to 85 parts of juice 15 parts by weight of apple pectin juice is added. The boiling helps to mix thoroughly. (5) The mixture is poured into receptacles and allowed to cool and jellyify, the slight scum which forms a few minutes after pouring out being skimmed off at an early stage.

1534. RONGO, V., AND QUIATSON, S. L. 547.458.88

Determination and extraction of pectin from citrus and other fruits.

Philipp. Agric., 1940, 29 : 1-11, bibl. 17.

The yield of pectin from 33 fruits, mostly citrus varieties, was determined. The yield ranged from 30.03% in Hung lemon to 1.55% in *Eugenia Cumini*. The pectic content of the extracted pectin varied in the different fruits from 74.26% in Ladu mandarin to 16.88% in tamarind. The amount of pectic acid seemed to be correlated with the jelly strength of the pectin. Purity of extracted pectins ranged from 97.44% in Szinkom (*Citrus deliciosa*) to 82.50 in *Carissa Carandas*. The extracted pectins were dextro-rotatory with specific rotations ranging from 240.0° for *Carissa* to 110.0° for *Antidesma Bunius*. The pectin of *Sandoricum koetjape* had the highest moisture content, 8.25%, and sour orange the lowest, 1.21%. Ash content of pectin was from 6.45% in rough lemon to 1.03% in tamarind. Total acidity varied from 32.80 m.l. of 0.1N NaOH per gram pectin in *Antidesma* to 3.09 in Hung lemon. Viscosity of 0.5% pectin solution varied from 2.060 in Hung lemon to 1.078 in Marsh seedless grapefruit pH value was from 3.4 of tamarind to 2.3 of *Lansium domesticum*. Jelly strength varied directly with viscosity and inversely with pH value. Pectin solutions having 2.6-2.7 pH value gave the best jellies and those having 2.9-3.4 the poorest.

1535. ARROYO, R. 663.543

Manufactura de ron. (**Rum manufacture.**)

Circ. Estac. exp. agric. Puerto Rico 106, 1938, pp. 70.

The object of this publication is to instruct the local manufacturers in the best methods of rum making in accordance with the facilities at their disposal. There is much misapprehension on the subject especially as regards fermentation and the author endeavours to point out and explain some of the mistakes commonly made.

1536. CROSS, W. E. 633.61-1.57

Existen muy pocas posibilidades de poder fabricar con éxito comercial, de los residuos de la caña, celulosa y papel. (**Poor commercial prospects for the conversion of sugar cane residues into paper or cellulose.**)

Circ. Estac. exp. agric. Tucuman 81, 1939, pp. 3.

Factors rendering the production of cellulose and paper from sugar cane waste unlikely, especially in Tucuman, include the following :—(1) lack of adequate customs protection, (2) the necessity for building factories capable of large daily output, (3) the necessity for keeping large amounts of residues from the time of harvest throughout the year, (4) the necessity for rivers with good supplies of water on the banks of which the factories must be set, (5) the value of the bagasse for burning and the considerable cost of drying and baling it, (6) the high cost of the prepared residues when compared with that of other sources of paper.

1537. WILBAUX, R. 633.73-1.56

Note préliminaire sur les enzymes et les réactions bio-chimiques du café, spécialement au cours de la préparation industrielle. (**Enzymes and biochemical reactions in coffee during industrial preparation.**)

Rapport annuel pour l'exercice 1938 de l'institut national pour l'étude agronomique du Congo Belge [I.N.E.A.C.], part 2, 1939, pp. 3-45, bibl. 16.

The biochemical reactions of coffee during its industrial preparation are discussed. Much yet remains to be learned. The marked differences observed between varieties indicates that details of the technique of preparation should be adaptable to the particular variety in hand. The effect of any operation which influences the interaction of the enzymes of the bean may differ considerably with the variety of coffee in preparation. So far no relation between taste and the activity of any diastase has been established, but there is some correlation between the liquoring quality and the degree of lipolysis of the fats. There is a table showing the "reactional aptitude" of 7 principal varieties, also their pH, their caffeine and their fat contents, with some notes, largely uncomplimentary, on the taste of each. It is emphasized that all findings are provisional.

1538. WILBAUX, R. 665.353.4 : 581.192
 La teneur en carotène de l'huile de palme. (**Carotene content of palm oil.**)
*Rapport annuel pour l'exercice 1938 de l'institut national pour l'étude agronomique
 du Congo Belge [I.N.E.A.C.], part 2, 1939, pp. 46-53.*

The author has examined analytically many samples of nuts of the oil palm (*Elaeis guineensis*) from several districts in the Belgian Congo. The results are tabulated. A seasonal variation in carotene content was found but could not be correlated with rainfall, length of insolation at various stages of fruit formation, or means or extremes of temperature. The actinic quality of the sun's rays are presumably of considerable importance. Factors influencing the elaboration of lipochromes are CO₂ content of the atmosphere (which has a retarding influence when it is high) and the degree of maturity; light and temperature are important but their influence varies according to the variety studied. There appears to be a well authenticated optimum as regards temperature at which elaboration is most intense. Carotene oxidizes very rapidly in air and can play the part of an oxidizing catalyst and hasten the rancidity of the oil. In any case, to maintain the quality of the oil it should be removed from air and light at the earliest moment.

1539. MOODY, F. O. 658.8
Plan and specifications for a small hot air drier.
N. Guinea agric. Gaz., 1940, 6 : 1 : 44.

The plans and specifications and list of materials are those of a native-operated hot air copra drier which has yielded consistently good results at Rabaul. It should deal with 1 ton of green meat every 24 hours=approximately $\frac{1}{2}$ ton of copra. One European and 2 trained natives should be able to erect it in 3 weeks.

1540. CAULFIELD-KELLY, E. 658.8
A handy and inexpensive "Ceylon type" kiln drier.
N. Guinea agric. Gaz., 1940, 6 : 1 : 48-51.

The construction and method of using this Ceylon-type kiln are described. It should be capable of turning out 1,000 tons of copra per annum.

1541. DEKKER, G. H. W. D., AND HALEWIJN, E. K. E. 633.91
 De bereiding van ilesmannaanmeel uit *Amorphophallus oncophyllus*.
 (**Preparation of Amorphophallus meal.**)
Bergcultures, 1940, 14 : 708-18.

An account is given of the preparation of amorphophallus meal or flour in Java. The raw material consists of the tubers of *A. oncophyllus* and *A. variabilis*. The former gives the best yield and is accordingly dealt with here. The economic side of the question is not discussed as the market is too uncertain. The yield of meal is about 10%. Drying of freshly cut up tubers must be carried out as quickly as possible or they start to decay. Sun drying will result in an excellent product but it is darker than that which is artificially dried with flue gases. The latter product is light yellow. Drying by artificial heat produces a similar colour to sun drying, light greyish brown. The uncleaned, unpolished meal is quite usable but its appearance is improved by winnowing and polishing. The dried meal can be stored for a long time. The incomplete solubility of the flour in water on account of certain granulations can be overcome by filtering. Except when granulated amorphophallus meal can be made into transparent sheets somewhat resembling cellophane and usually with no reduction of quality. In this form its advantage is that there is no insoluble residue. In the making of waterproof fabrics it appears that the amorphophallus film becomes considerably more supple if ammoniated latex is mixed with the gel. The quality of the rubber in the amorphophallus film requires further research. On the other hand amorphophallus gel is a useful coagulator for fresh latex. The above is a general summary. In the paper the methods of carrying out the various processes alluded to are fully described and illustrated.

1542. ADAM, W. B., AND STANWORTH, J. 664.8.036.5
Heat penetration in rotating cans.
A.R. Fruit Veg. Pres. Res. Stat. Campden for 1939, 1940, pp. 55-9, bibl. 1.
 BALLS, A. K., THOMPSON, R. R., AND JONES, W. W. 634.651 : 581.192
Crude papain. Preparation and properties.
Industr. Engng Chem. (industrial edition), 1940, 32 : 1144-7, bibl. 3.
 HARVEY, M. T., AND CAPLAN, S. 634.573-1.56
Cashew nut shell liquid.
Industr. Engng Chem. (industrial edition), 1940, 32 : 1306-10, bibl. 8.
 Processing of the liquid and its products.
 BABA, T. 633.682 : 581.192
Investigations on the fermentation of cassava starch by newly discovered bacteria. [Japanese, German summary.]
Bull. School Agric. Taihoku 1, 1940, pp. 59-93, bibl. 7.

NOTES ON BOOKS AND REPORTS.

1543. JACKS, G. V., AND WHYTE, R. O. 631.459
The rape of the earth.
 Faber & Faber, London, 1939, pp. 313, £1 1s.

"Erosion in nature is a beneficent process without which the world would have died long ago. The same process, accelerated by human mismanagement, has become one of the most vicious and destructive forces that have ever been released by man" [Jacks]. In this book the authors set out to show the causes and devastating effects of the erosion of the soil which in spite of attempts to check it is almost everywhere robbing the earth of its fertility and that with ever increasing speed. That this erosion is a more potent threat to civilization than the activities of even the most bloody-minded of dictators is pointedly brought home by a consideration of the many civilizations that have perished in the past from the washing away or burial of their lands under sand or mud. Nations which have survived are those which have succeeded, whether by design or circumstance, in preserving the fertility of their soil. Erosion is practically universal except in Western Europe and immunity there is attributed to the adaptation of its agriculture to its climate. Elsewhere the authors see nothing for a threatened country but its ultimate extinction unless the whole agricultural management of that country and even the way of life of its people are radically changed. Successive chapters debate the causes of erosion, physical, economical and political, in every continent and in India. The secondary causes are many and varied but the fundamental cause is always the same. It is man who sets in motion the mechanism which will ultimately destroy him. But every country by now has realized the danger and much of the book is taken up in discussion of the many remedial and preventive measures in force throughout the world. In Japan and Java, for instance, erosion has been completely checked, largely because, possessing dense populations mainly dependent on the soil, any loss of soil fertility has an immediate effect on the local economy and is remedied without delay. Some of the most interesting chapters of the book are those dealing with the political and social consequences of erosion. In fact here is not only a comprehensive textbook of the physical aspects of erosion but a valuable sociological study presented with much literary ability and considered from an angle which to many will be entirely new. The photographs which provide the illustrations are admirably clear, often startling and occasionally dramatic. To employ a current catchword the book "makes you think" and that in these exciting days is no mean achievement. It remains to hope that thoughts can be translated into a co-ordinated and successful action.

1544. GERICKE, W. F. 663.61 : 581.084.1
The complete guide to soilless gardening.
 Putnam, 42 Gt Russell St., London, 1940, pp. 285, 12s. 6d.

In this latest book on hydroponics the American author adds considerably to the information available to those who feel drawn to this new form of plant culture in which the more ordinary medium of soil is eliminated. After discussing the experiments of such men as Knop and Sachs whose essential purpose was respectively to study the basic relationship of soil to crop

production and plant processes in general, he shows how later work of the Laboratory of Plant Physiology at the Johns Hopkins University played an important part in laying the foundations for hydroponics. He describes the development of present-day technique and gives a detailed description of all the apparatus necessary for the establishment of a modern "hydroponicum". The culture basins have been successfully made from asphalt paper stretched on wooden frames, from concrete, sheet metal and wood. Care is necessary in constructing the seed bed which lies a little above water level and consists essentially of a fine meshed wire net covered with wood excelsior, a layer of straw or other coarse material. The preparation of the nutrient solution necessitates considerable care both as regards the basic formula and the pH, and naturally the chemical constituents of the water used must be fairly accurately known. Physical conditions in the solutions need careful attention. Change in nutrients available can be gauged by well defined symptoms in the plants and can be remedied as required. Instructions are given for the growth in water of the following crops:—tomato, cucumbers, melons, etc.; potatoes; carrots, beets, turnips and other root vegetables; onions; green vegetables such as lettuce, cabbage, etc.; perennial vegetables and berries; herbaceous annual flowers; flowers from bulbs, corms, etc.; flowering woody perennials. The latter part of the book is devoted to considerations of commercial, garden and home production, mineral composition of plants, sand culture and the relation of hydroponics to agriculture, with particular reference to the economic production of cereals and mixtures of such crops as potatoes and corn, potatoes and tomatoes. The book is purposely written in simple language and the chemical reactions involved are explained briefly and simply. Yet though it seems to the reviewer that the amateur would be liable to plenty of uneconomic and somewhat irritating experimental disasters before he managed to rectify without delay errors in pH or even disturbance of ordinary mineral content of his culture solutions, for that the author cannot be blamed. He does not suggest that this is a cure-all, fool-proof system. All that he appears to claim is that it has under Californian conditions and with careful management considerable prospects of an economic future. Trial installations are already in being in England at Reading and elsewhere [see *H.A.*, 9 : 848; 10 : 1291].

1545. NICOL, H.

577.15.04

Plant growth-substances.

Leonard Hill, London, 2nd edition, 1940, pp. 147, 8 bibliographies, 7s. 6d.

This second edition of a book published in 1938 (*H.A.*, 8 : 1337) will be welcomed by layman and scientist alike. It forms a survey, very fully documented, of the present state of knowledge of the synthetic chemical substances which are now increasingly used in propagation work, especially in the rooting of cuttings. It is not only just as pleasantly readable as the previous edition but it brings the subject up to date with brief accounts of the work since 1937 on the treatment of seeds, the use of growth-substances in grafting, and the question of bud inhibition and retardation of flowering by the very substances which are known to promote root production. The author objects to the use of the terms phytohormones or plant hormones for these synthetic products. The term "hormones" should, he considers, be confined to substances originating in the plant itself such as the auxins, vitamins B₁, C, rhizocaine, florigen, etc. For the synthetic products he suggests "phytamines" or "growth-regulating substances", abbreviated to growth-substances.

From the mass of rapidly accumulating literature dealing with fresh trials of these synthetic substances the author has selected and gives the gist of the findings of some of the more practical and recent papers covering a multitude of plants and chemicals.

In addition he devotes chapters to chemistry in relation to growth, classification and nomenclature of growth substances, synthesis of growth substances and identification of growth substances and certain related substances. Ample references to work on particular phases and a good index greatly assist the reader.

1546. TALBERT, T. J., AND MURNEEK, A. E.

634.1/8

Fruit crops. Principles and practices of orchard and small fruit culture.

Baillière, Tindall & Cox, London, 1939, pp. 345, short bibliographies, 20s.

The authors state in their preface that the aim of this book is to present undergraduate students with a complete and modern view of the culture of fruit crops. That the view is to be from a

transatlantic angle is made clear in the lists of references which contain only one European book, namely, Bedford and Pickering's "Science and Fruitgrowing" published in 1919. In 1940 one cannot refrain from asking how far any view of fruit culture can be considered complete which ignores rootstock as a factor in tree performance. This book gives no hint of any relationship between stock and tree size, fruit quality, tree nutrition or fruit storage, and makes no mention of the problem of stock-scion incompatibility. The other main factors in fruit management from nursery to market are dealt with in separate chapters, and special sections give the history and culture of most of the temperate fruits. In view of the mass of recent American work on minor elements and on growth-promoting substances it is strange to find here no reference to either of these two subjects or any allusion to functional diseases such as bitter pit, scald, or water core. Virus diseases are dealt with in three short paragraphs, but no reference is made to any virus diseases of strawberries. The book is well illustrated and has a good index. N.B.B.

1547. SAUNDERS, L. H.

635.1/7 : 551.566.1

Vegetable growing in the tropics.

Oxford University Press, London ; Humphrey Milford, 1940, pp. 120, 3s. 6d.

The first two chapters of this book contain sound general horticultural advice. Chapter 3 provides cultural and culinary notes for a number of European and some tropical vegetables. Chapter 4 which concludes the book gives directions for bottling such vegetables as lend themselves to it. Although written to cover the tropics the book has a slight West African bias. This is all to the good, since reliable gardening information for this part of the world is rare whereas other tropical regions are already reasonably well catered for, though possibly in not so handy a form. It is a surprise to realize what a number of vegetables from temperate lands can be brought, if not to perfection, at any rate to some degree of edibility under such unaccustomed conditions. Much depends on selecting the most suitable horticultural variety of any vegetable required to meet these conditions. Recommendations to this end are made in each case and should save many a disappointment. The book is well worth its published price.

1548. OCHSE, J. J., AND DE JONG, W.

635.1/8 : 551.566.1

Europeesche groenten. (**European vegetables in the tropics.**)

Volkslectuur, Batavia-Centrum Serie 490, 3rd edit., 1932, pp. 109.

This handbook [recently received] is a useful guide to the cultivation of various kinds of European vegetables in the tropics. Most of the cultivation is done at high altitudes in Java where the climate is reasonably cool but the lowest altitude at which the plant can be expected to succeed is usually mentioned. Photographs show the excellent appearance of the crops grown.

1549. PRAIN, D., AND BURKILL, I. H.

633.685

An account of the genus *Dioscorea* in the East.

Part 1. The species which twine to the left.

Annals of the Royal Botanic Gardens, Calcutta 14, Part I, pp. 210 + 6, 91 plates.

Alipore : Bengal Govt. Press, 1936, Rs. 75 or £5 13s.

Part 2. The species which twine to the right with addenda to Part 1 and a summary.

Annals of the Royal Botanic Gardens, Calcutta 14, Part 2, pp. viii + 211-528 + xx + plates 86-150. Alipore : Bengal Govt. Press, 1939, Rs. 67 or £5.

"In short, this monumental achievement can claim to be an exhaustive account of the *Dioscoreas* of the East, and it seems difficult to believe that anything is left for further investigation." [From review in *Nature*, 1940, 146 : 503. For reviews of early part see *Nature*, 1939, 144 : 895 and 1938, 141 : 182.]

1550. CHRONICA BOTANICA.

58 : 05 + 06

***Chronica Botanica.* Vol. 6, No. 1, pp. 1-23.**

P.O. Box 151, Waltham, Mass., U.S.A., \$7.50 a year post free, single copies \$0.40.

We welcome the reappearance of Dr. Verdoorn's enterprising journal in fortnightly form. Its sub-title "The International Plant Science Newsmagazine" aptly describes it. Its news snippets of men, journals and associations are not readily to be found elsewhere and once in a library it will often be consulted. We wish it and its editor luck in their new home.

1551. UKRAINIAN ACADEMY OF SCIENCES, INSTITUTE OF BOTANY. 583.5+584.2
Ukrainian flora. (Ukrainian with Latin names and descriptions.)
 Ukrainian Academy of Sciences, Kiev, 1938, Vol. 1, 2nd Edition, pp. 199 + 52
 figs.

Descriptions of pteridophytes and gymnosperms growing in Ukraine with notes on their distribution elsewhere.

1552. LAMM, R., LENANDER, S. E., AND HYLMÖ, B. [ALNARP]. 635.1/7
 Redogörelse för stamförsök och statskontroll av köksväxtstammar vid statens
 trädgårdsförsök år 1938. (**Report of the State Experiment Station for Veget-**
ables at Alnarp for 1938.) [English summary 7 pp.]
 Reprinted from *Årsskrift för Alnarps Lantbruks-, Mejeri- och Trädgårdsinstitut*
 1939, pp. 136.

A clear account is given of the very careful methods adopted by the Swedish State Seed Testing Station for testing vegetable strains and safeguarding both producer and the public from fraud. The essential point in the method is the marking of the tested and approved seed with a colourless chemical solution, the nature of which is secret. A number of different solutions have been tested for use in the case of the different firms and different years. A large list is given here of vegetable strains suitable for growing in Sweden with notes on qualities of individual strains. It would appear to cover all types of vegetable normally grown in England.

1553. ARKANSAS. 634/5
Fifty-first Annual Report for fiscal year ending June 30, 1939,
 1940, pp. 110.

Among horticultural research items briefly mentioned (pp. 74-85) the following may be noted :—The production of parthenocarpic fruiting in tomatoes by the application of growth substances and of petunia and egg plant pollen to the stigmas. In only one instance was viable seed obtained and this is believed to have been due to accidental pollination. Hairy vetch proved the most satisfactory cover crop following clean cultivation during the summer in an apple orchard. Sod consisting of a mixture of orchard grass, red top, red clover and alsike allowed nearly as much growth of apple trees as a combination of clean culture followed by vetch cover, but needed a heavy application of nitrogen for both trees and sod. Bermuda grass proved too great a competitor for water. Lespedeza was good as a sod cover in both peach and apple orchards but caused severe dwarfing in another peach orchard. There are indications that no sod culture should be grown in a young orchard without a cultivated strip 4 to 5 ft. wide on each side of the trees. Montmorency cherries showed about equal results in growth and cropping on mazzard and on mahaleb stocks up till 1939, but as a result of a late freeze in the spring of 1939 trees on mahaleb gave about a 40% crop, those on mazzard nil.

1554. ASSAM, DEPARTMENT OF AGRICULTURE (MITRA, S. K.). 634.1/7
Annual Report of the Department of Agriculture, Assam, for the
year 1938-39, 1940, pp. 239 + ii, 6s.

Work at the Fruit Experiment Station, Shillong, on deciduous fruit includes trials of local stocks for pears and stone fruits. For apples suckers from existing trees are being used and a local stock called Sohphoh Khasi (*Docynia indica*) is also being tried. A station has just been established at Burnihat for investigations into citrus problems. Its aims include :—The collection and classification of citrus, both wild and cultivated, together with exotic varieties available in the province ; a survey of wild types ; investigations into the suitability of indigenous citrus stocks for budding ; light on manurial requirements ; control of pests and diseases.

1555. BASUTOLAND. 631.543
Annual Report of the Department of Agriculture, Basutoland, for
Report Year ended 30 September, 1939, 1940, pp. 77.

The following items from a comprehensive report interest this Bureau. The most successful grasses in soil conservation, i.e. anti-erosion, are Kikuyu grass and *Cynodon dactylon*. These are transplanted from nurseries to the site. Sown grasses have proved disappointing largely

because of excessive grazing. *Robinia pseudo-acacia* and *Populus canescens* have proved the most suitable trees for the same purpose.

1556. BRITISH HONDURAS.

633/634

Report of the Department of Agriculture, British Honduras, for the year 1939, 1940, pp. 20.

There is little of research interest to be noted, but the gallant struggle of the Agricultural Officer to imbue the peasantry and smallholders with a few elementary agricultural and other principles is apparent. In other directions the report shows clearly the considerable effort that the Government is making to put the agriculture of the Colony on a sound and self-supporting basis.

1557. BURMA.

634/635

Report on the operations of the Department of Agriculture, Burma, for the year ended 31st March, 1939.

Rangoon, 1939, pp. 248 and xxix, price Rs 3·8 or 5s. 3d.

The report consists of a summary of work and progress, reports of departmental chiefs on the various departments and agricultural circles in their charge and 11 appendices, of which No. 1 is a very welcome glossary of the local terms freely besprinkled in the reports. The others are tabulated statements connected with the administration of the departments. There is little of horticultural as distinct from agricultural interest, but a few items briefly noted may be mentioned. At Mudon mangosteen was grafted on what is referred to as "*speciosa* stock". Fifty-two out of 60 made successful union but 50% were lost later. Mango was inarched on "sinnin" stock (not in the glossary) and sapota (*Achras Zapota* L.) on itself and on *Mimusops Kauki* L. The latter gave the better results. Attempts to bud sapota failed. Colombo lime proved superior to Malta lime in budding experiments in which the scions were Jaffa orange, Singapore pomeloes and Australian grapefruit. Using Hortomone improved rooting was obtained with marcots of mango, orange, grapefruit, rambutan (*Nephelium lappaceum* L.) and durian (*Durio Zibethinus* Mura). With cuttings of citrus, mangosteen and sapota there was no success.

1558. CALIFORNIA.

634.653

Yearbook of the California Avocado Association 1939, 1939, pp. 181, \$3.00.

Among articles of particular interest to avocado growers in other parts of the world the following may be noted:—Wilson Popenoe describes a recent exploration trip to different countries of S. America in search of avocado types which may in the future prove useful to the breeder or of sources where such types are likely to be found. Regions offering such sources he considers to be Mexico, especially Atlixco, Michoacán and Oaxaca, and Guatemala for wild avocados of the Guatemalan race. H. S. Fawcett gives two pages of observations on avocados in Brazil. F. F. Halma and A. Courtney discuss briefly the time taken by different varieties to recover from the results of the 1937 frost. P. Heismann contributes a 5 page, well illustrated article, on avocado anatomy. A. R. C. Haas describes experiments to determine the effect of wind on growth and transpiration of seedlings, the effect of root temperature on the growth of walnut and avocado seedlings, avocado leaf symptoms characteristic of potassium, phosphate, manganese and boron deficiencies, and finally the effects of pH on the growth of avocado seedlings.

1559. CANADA; DEPARTMENT OF AGRICULTURE.

634/5 : 551.566.3

Progress Report Division of Illustration Stations 1934 to 1938. Part II. Manitoba, Saskatchewan, Alberta and British Columbia, 1939, pp. 130.

Horticulture plays only a small, though important, part in the system of the Illustration Stations of the four western provinces. Severity of climate precludes the growing of any but hardy fruits. Generally speaking these are confined to crab apples and a few ordinary apple varieties, plums (several Minnesota varieties such as Haralson), plum cherry hybrids of the top fruits, and among small fruits raspberries, red, black and white currants and gooseberries. An account is given of the production and growth of these and of vegetables at Kenville Station, Manitoba, at several stations in Saskatchewan and in the Peace River District. Shelter belts prove extremely valuable.

1560. CANADA, DEPARTMENT OF AGRICULTURE. 635.1/7 : 551.566.3
Experimental Sub-Stations. Results of experiments for the years 1931 to 1938, 1940, pp. 57.

Most of this publication is concerned with work at the Fort Vermilion Station, Alberta. The horticultural work centres chiefly on the selection and cultivation of vegetable varieties capable of growing under the meteorological conditions of short summers and long, severe winters with an average rainfall of 11.6 inches and a mean annual temperature of only 27.3 F. There is a wide range from a mean of 60.6° for July to one of -12.2 for January. The total sunshine averages 2,089.4 hours, ranging from 71.1 hours in January to 301.0 hours in July. Suitable varieties of different vegetables and flowers are recommended. The Station itself was moved to a fresh site in 1936. The work of the following sub-stations is also reported :—Fort Smith N.W.T., Fort Resolution N.W.T., Fort Providence N.W.T., Fort Good Hope N.W.T., Carmacks Y.T., Carcross Y.T., and Betsiamites, Que.

1561. CANADA, MINISTER OF AGRICULTURE. 634/5
Report of the Minister of Agriculture, Canada, for the year ended 31 March 1939, 1939, pp. 138, 25 cents.

This report contains many items of interest to the horticulturist. Among them are the following : Fruit insect investigations in Nova Scotia, Quebec, at Vineland, Ont., Summerland, B.C. and Victoria, B.C. Biological control of such insects as the oriental fruit moth, codling moth, pea moth, etc. The work of the various Dominion plant pathological laboratories. *The Division of Horticulture* reports tests of hardy frame builders for apple trees, and work on the following : foliage disorders due to magnesium-, potassium- and boron deficiencies, freezing quality of pears, fruit juice manufacture and storage, tomato juice and vegetable dehydration. Storage problems include treatment of fruit in the orchard and during storage, core flush, fumigation of apples. Vegetable experiments have included breeding or selection of beans, beets, cucumber, onion and peas. *Tobacco Division*. Among other investigations that on growth hormones has shown that the rate of growth of tobacco seedlings is accelerated by all methods of application of growth hormones provided the optimum concentration is used. Plants treated at 3-day intervals with 50 c.c. hormone solution at 1/100 p.p.m. increased 80% in green weight as compared with controls at transplanting. *Branch Farms and Stations*, Kentville, N.S. :—Trials were made of selections of crosses between the apple varieties Cox's Orange and Golden Russett. In storage promising results were obtained, especially with pears, from the use of high concentrations of nitrogen for short periods. Fredericton, N.B. :—In potato breeding a South American species, *Solanum demissum*, seemingly frost resistant, is being investigated. Morden, Man. :—Of 10,000 seedlings which bore fruit for the first time 142 showed virtue enough to warrant immediate propagation. Apricots have now been established as a dependable crop. In vegetable tests promising new varieties are noted in corn, cucumber, pepper, tomatoes, musk melons and water melons. Rosthern, Sask. :—Some of the plantings of the 40,000 seedling fruit trees first started in 1935 are now bearing fruit. Summerland, B.C. :—Hibernal and Virginia crab are found to be promising hardy framework stocks for apples. McIntosh seedlings form excellent rootstocks. Trials show that pruning has tended to be too severe with young apple trees. Picking at the correct time is essential and, it is here suggested, can largely prevent breakdown, storage scald and bitter pit. Improved processes for preservation of fruit by canning, dehydration and jamming have been devised. Saanichton, B.C. :—Pollination trials have allowed the segregation of most of the self-sterile fruit varieties.

1562. CARNEGIE INSTITUTION OF WASHINGTON. 575/577
Annual Report of the Chairman of the Division of Plant Biology, being reprinted from Yearb. 38, for the year 1938-9, 1939, pp. 107-41.

Articles of special interest to horticulturists concern (1) Biochemical investigations into the organic nutrition of plants, into oxidation : reduction reactions in killed leaves, into the electrophoretic-chromatographic adsorption method, into absorption of CO₂ by unilluminated leaves, into determination of the absorption coefficients of chlorophyll. (2) The quantum efficiency of photosynthesis. (3) Desert investigations. (4) Ecological studies on adaptation and origin.

1563. CEYLON, COCONUT RESEARCH SCHEME. 634.61

Report and accounts of the Coconut Research Scheme for 1939.

Sessional Pap. Coconut Research Scheme (Ceylon), 8, 1940, pp. 21, 25 cents.

A few notes are given on work done. Much of this has been already published and abstracted. The remainder of the report is concerned with the Scheme's accounts.

1564. CEYLON, DIRECTOR OF AGRICULTURE. 63(012)

Administration Report of the Acting Director of Agriculture, Ceylon, for 1938. Part IV. Education, Science and Art (D),
1939, pp. 98, Re. 1.

The work of the Department of Agriculture for 1938 is reviewed. There are a few pages of notes on the horticultural experimental work in progress but results are not discussed. Most of the experiments are long term.

1565. CEYLON, RUBBER RESEARCH BOARD. 633.912

Report of the work of the Rubber Research Board, Ceylon, in 1939,
1940, pp. 134.

The report deals briefly with the experimental work. This comes chiefly under the headings *Oidium* leaf disease, root disease, die back of the cover crop, *Pueraria phaseoloides*, which is at present attributed to soil sickness, control of birds-eye spot (*Helminthosporium Heveae*) on Hevea seedlings by means of light overhead shade, selection of planting material, forms of treatment of budded stumps prior to planting, breeding, tapping systems among others. Much of this has already been abstracted in *Horticultural Abstracts*.

1566. CEYLON, TEA RESEARCH INSTITUTE. 633.72 : 016

General index to the publications of the Institute 1926-1938.

Bull. Tea Res. Inst. Ceylon 20, 1940, pp. 125.

This is a very comprehensive subject index to the publications of Tea Research Institute. The publications thus indexed are (1) the *Tea Quarterly*, Vol. 1-11, (2) bulletins comprising the annual reports and special detailed accounts of particular phases of the Institute's work, and (3) special publications normally issued for limited circulation only, in this case consisting of The Report on a visit to Java by J. Forbes, Junr. and R. V. Norris, issued in 1935. All connected with tea research should be extremely grateful for this useful compilation.

1567. CEYLON, TEA RESEARCH INSTITUTE. 633.72

Annual Report of the Tea Research Institute for 1939, 1940, pp. 78,
being *Bull.* 21.

Plant physiology. A modified procedure to avoid waste of effort in selection has been worked out. After each of the first two groups of 8 pluckings 50% are eliminated, the discards being reduced to 33% after each of the subsequent 8 pluckings, until 40 pluckings have been made in all, when the final selection is made from survivors. The final result is the retention of some 2% of the original bushes for propagation and clonal trial. As regards propagation from cuttings the losses between striking and planting out are still too heavy.

Agricultural chemistry. The manurial experiments now in their ninth year continue to give valuable information. An investigation showed that there was no loss of nitrogen from fertilizer mixtures in storage. In weed restriction experiments intensive cultivation reduced the crop about 5%, possibly through a restriction of the roots. Annual forking is suggested over the whole area as being the method which will probably obtain the best results from manures supplied and preserve the mulch and soil cover. Weekly grafting of buds on to their own stocks was carried out for a year. The best months were October to February. The above notes are but a very small portion of the whole.

1568. DEVELOPMENT COMMISSION. 63
Twenty-ninth Report of the Development Commissioners, being for the year ended the 31st March 1939.

H.M. Stationery Office, Kingsway, London, W.C.2, 1940, pp. 133, 2s.

As usual an account is given of the purposes and the amounts of government grants made in the year 1938-9 to the various agricultural research and educational institutes in the United Kingdom.

1569. ALGEMEEN LANDBOUW SYNDICAAT, DUTCH EAST INDIES. 634/5
Verslag over het jaar 1939 van het Algemeen Landbouw Syndicaat enz. (Report for 1939 of the Algemeen Landbouw Syndicate and others.)
 Ruygrok & Co., Batavia, 1939, pp. 249.

A combined annual report of the activities of the agricultural and horticultural research stations and their satellite associations concerned with perennial crops in the Dutch East Indies. In view of their number the reports are necessarily brief. They deal very largely with work in progress but results of concluded experiments are to be found sandwiched in among the rest. Conditions of such experiments are not given.

1570. BESOEKISCH PROEFSTATION RUBBER, KOFFIE EN TABAK (SCHWEIZER, J.). 633/71
Jaarverslag tabak over Juli 1938 t/m Juni 1939. (A.R. tobacco July 1938-June 1939.)

Meded. bezoek. Proefst. Rubber, Koffie en Tabak 64, 1939, pp. 64.

The scientific section of the report discusses the research work of the report year. The subjects cover breeding and selection (X ray and colchicine treatments were ineffective in their respective aims); plant spacing trials (the wider spacings were best for quality and development); manurial trials; pests and diseases (description and control); chemistry; curing. In conclusion there is a programme of the work laid down for 1939-40.

1571. INDIA, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH. 633/634
Agriculture and animal husbandry in India 1937-38, 1940, pp. 416, 9s. 3d.

This report surveys the agricultural position in India for 1937-38 and gives some account of the results obtained in research and of the working of the various agricultural services. Abstracts on the research in progress obtained from other sources have been made frequently in *Horticultural Abstracts*. The notes given below are drawn from one chapter only, "Economic work on crops", and even so are very far from being a complete summary of it. *Tobacco*. Work carried out at many important centres is recorded. It consisted of manurial, cultural and curing experiments; comparative trials; breeding; the search for areas to which cultivation of the crop could be suitably extended especially of cigarette tobacco. In Madras a cross between a local and exotic type has produced a strain of superior yield and quality good enough for issue for general cultivation. Green manuring (Madras) was found to depress yield. *Groundnut*. Promising selections have been made. An intensive study of groundnut was started in Madras. Spreading varieties possessed a better developed root system than bunch varieties. There was no response to nitrogenous manures. Potassium sulphate at 1 cwt. and superphosphate at 2 cwt. per acre increased yield. *Coconut*. In breeding natural and cross fertilization progenies proved more vigorous than those resulting from selfing. The shedding of very young nuts was proved by artificial fertilization to be unconnected with pollen scarcity. A spacing 30 x 25 feet is the most profitable in Travancore. Special investigation of coconut diseases has been sanctioned by the I.C.A.R. *Tea*. There is no general need for nitrogenous manuring in the tea districts of N.E. India. The average tea soils have little immediate need of phosphoric acid or potash for mature tea, but young bushes in their second or third year have shown benefit from the use of potash. In manurial experiment plots sulphate of ammonia combined with superphosphate and potash has for 19 consecutive years proved superior in results to the same quantity of nitrogen given in other forms. Cattle manure and vegetable compost possess only 50% of the efficiency of sulphate of ammonia for an equal quantity of nitrogen so far as the crop is concerned. Loss of quality is associated with crop increase but not with the type of manure used to effect the increase. The average crop of seed set by self-pollinated bushes is about

a quarter that obtained by cross-pollination and self-fertilized seed is inferior in vigour and germination. *Coffee*. The control of coffee leaf disease (*Hemileia vastatrix*) does not depend primarily on spraying when the greatest amount of leaf is on the tree. Three strains of *Hemileia* have been isolated. Whereas certain strains of coffee of known parents may be resistant to two strains of *Hemileia* they may still be susceptible to the third. There is a positive correlation between a good set of fruit and the rapid growth of flush immediately after the blossom showers. Various defects in the bean are shown to be due to moisture and nutritional disturbances during development. In spite of 25 years of investigation the coffee stem borer, the most serious pest of arabica coffee is still uncontrolled. In selection work the standard set is the unfailing production annually for a number of years of 5 lb. of ripe cherry. The seed of a strain with this performance and the added advantage of resistance to leaf disease is being distributed. Other investigations concern vegetative propagation and the effect on quality of such factors as altitude, time of picking, methods of drying, grading of wet parchment and fermentation. *Fruits*. The value of leaving a chip of wood at the back of the bud has been proved in the case of the Chinese orange on Kichili stocks at the Fruit Experiment Station, Anantarajupet. This station also has records on the topping of Kichili rootstocks, rootgrowth of citrus stocks, the inarching of 3-4-months-old mango stocks, the propagation of mango by ringed cuttings. The effect of synthetic growth hormones on cuttings of mango and grapefruit is being studied at Dacca. At Sabour a short drying interval between the ringing of the bark and the application of the mud produced better gootee plants in litchi. In the Punjab seedling citrus stocks have produced more lateral roots with a wider zone of distribution than those raised from cuttings. Kharna Katta stock imparts vigour to the scion. The Santra orange is very susceptible to rootstock influence at Nagpur. A large collection of rootstocks from East Malling is under trial in Baluchistan. Some physiological and cultural observations are given from various stations. Malta oranges have benefited from liming the soil and pineapples have yielded better when grown on ridges at Krishnagar. Biennial bearing of mangoes is not a regular phenomenon. The performance of selected mangoes bearing in the off season is being recorded in Madras and in Bihar and Orissa. Cultivation has improved growth and yield of mangoes in Bihar. Manurial experiments with mangoes are in progress in many provinces. The cultivation of cordon fruit trees in Baluchistan has been promising. The American bush system of growing vines is being compared with the indigenous trench system.

1572. INDIA, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH. 633/634
Annual Report of the Imperial Council of Agricultural Research
for 1939-40, 1940, pp. 170, 2s. 3d.

Brief summaries are given in Chapter IV on Fruit Research of the investigational work on fruit in the different Provinces of India, especially in Madras, the Punjab and the U.P. (Chaubattia). Other shorter chapters comment on the working of the various fibre schemes, on oilseed research, on tobacco research and on potato research. A list of 329 journals received in the library of the Council is given.

1573. GOVERNMENT OF INDIA. DEPARTMENT OF EDUCATION, HEALTH AND LANDS. 633/634
Sixth report showing the progress made in giving effect to the
recommendations of the Royal Commission on Agriculture in
India. II. Provincial governments and administrations, 1940,
 pp. 167, 3s. 6d.

The horticultural research mentioned in these reports has already been dealt with in some detail in previous numbers of *Horticultural Abstracts*.

1574. IOWA. 634/5
Agricultural Experiment Station Report on agricultural research
for the year ending June 30, 1939, 1939, pp. 271.

Work on apple stocks indicates that superior stocks can be produced from seed taken from such varieties as Whitney, Wealthy, Windsor, Allen Choice and Ames 550. Among northern varieties two of the outstandingly hardy varieties, Hibernial and Virginia Crab, produce worthless seedlings. Other northern varieties whose seedlings are valuable as stocks are noted. The

Hopa Crab produces seedlings many of which have a high scab resistance, while Ames 550 produces seedlings highly resistant to woolly aphid. Interest in dwarfing stocks is growing. Malling IX is not hardy enough for mid-western conditions. Among promising stocks for this region are *Malus Sargentii* noted for hardiness and fine root system and a dwarf stock discovered at Muscatine, Iowa, which is hardy enough to withstand -25°F . It is slow growing but can be successfully grown by using it as an intermediate worked on seedlings of Ames 550. Experiments are in progress in which the effect of insertion of rings of bark of varieties showing dwarfing tendencies into the stems of standard apple varieties is being noted. Double working experiments indicate that trees double worked on stocks are more uniform than trees worked on own-rooted stocks. Peaches are being bred for hardiness. Ten seedlings of a cross of J. H. Hale \times *Prunus pedunculata* are being examined. *P. pedunculata* is hardy at temperatures even below -40°F . Trials of freezing preservation of fruits and vegetables indicate that the refrigerated locker can be successfully used for snapbeans, sweet corn, lima beans, squash, strawberries, raspberries and peaches. The temperatures ranged from 7° to 10°F , the vegetables and peaches being successfully stored thus for 7-8 months, the strawberries 11 months and raspberries 10 months. Vegetable trials include potatoes, sweet potatoes, asparagus, cucumbers, lima beans, musk melons, etc.

1575. JAMAICA.

634

Annual Report of the Department of Agriculture, Jamaica, for year ended 31 December, 1938, 1939, pp. 98.

The report deals with the activities of the Department, which are numerous and comprehensive. A few results of experimental work are given. The botanist's report contains some interesting remarks on banana breeding. In cold storage experiments with fruit from *Cercospora* leaf-spot affected trees and from uninfected trees the fruit from infected trees compared favourably in ripening and flavour with the controls but the fingers were thinner and shorter.

1576. JOHN INNES.

634/5

Thirtieth Annual Report of the John Innes Horticultural Institution for the year 1939, 1940, pp. 20.

The work of the different sections is briefly reported. It includes:—the design of a low pressure soil sterilizer; testing of British peats for suitability in composts; hybridization of blackberries; origin of triploid and tetraploid raspberries; classification of pears on morphological basis; genetical and cytological studies of *Prunus*; cross-sterility in apples and cherries; fruit development in pears; shy cropping in plums; character of "rogue" tomatoes; hybrid vigour and increased yield in tomatoes. Genetical studies have embraced tomato, *Primula sinensis*, *Streptocarpus*, *Verbena*, maize, *Lotus* and *Pisum*. The work of the biochemical section now falls into two parts: an extension of earlier work on the genetics of anthocyanic variation in a physiological direction and more strictly chemical investigations into other plant-colouring matters; plants under examination include *Papaver* spp., *Dahlia variabilis*, *Streptocarpus*, *Verbena*, *Primula sinensis*. Cytological investigations have concerned *Paris*, *Trillium*, *Paeonia*, *Allium*, *Tulipa*, *Tradescantia*, *Hyacinthus*, *Fritillaria*, *Forficula* and others.

1577. LANGE OSSEKAMPEN.

634.1/8-1.8

Jaarverslag van de werkzaamheden in het jaar 1938 verricht op het centrale bemestingsproefveld voor de fruitteelt "de Lange Ossekampen". (Annual report of the fruit tree manurial experiment station, Lange Ossekampen, Wageningen, Holland, for 1938), pp. 28.

The report is a general one of the work done and some experiments in progress. The year was generally unfavourable for fruit so that as far as yield is concerned results of experiments could not be considered normal. As the author remarks, "We saw the result of a year's work disappear in a night". Additional land was taken in by this station which began its work in 1935.

1578. NEW ZEALAND, DEPARTMENT OF AGRICULTURE.

634 + 633.7

Annual Report of the N.Z. Department of Agriculture for 1939-40, 1940, pp. 51.

The report of the director of horticulture covers pages 38-43 and deals with the economic developments of New Zealand horticulture during the year. Notes are given on the following, among

other, subjects:—the fruitgrowing industry; export of fruit; local markets; imported fruits, etc.; cold storage; instructional and experimental work; viticulture and wine making; cider making [considerable interest is now being displayed in both wine and cider making]; the Te Kauwhata Horticultural Station; tobacco culture; hop culture; the Royal N.Z. Institute of Horticulture; bee keeping.

1579. NEW ZEALAND, D.S.I.R.

634.1/7 + 664.85

Fourteenth Annual Report of the N.Z. Department of Scientific and Industrial Research for 1939-40, 1940, pp. 100, 2s.

Fruit research report (pp. 45-52). Items discussed include:—Apple fertilizer experiments—crop increases are resulting from N and NPK applications at Appleby, but in the long term experiments at Upper Moutere trees treated with nitrogen only are going back rapidly both in size and quality of fruit—; apple rootstock trials with 6 varieties on 5 Malling stocks and Northern Spy; inarching to eliminate stunting; pruning. Plant protection studies in the apple orchard comprise work on red-mite, leaf-hopper, bronze beetle, mouldy core, eye rot, scab, canker, bitter rot, internal cork, spraying and therapeutants. Pear mealy-bug and russet and spray injury to pears are being investigated. With regard to stone fruits attempts to check by injection silver leaf artificially inoculated into peach trees have so far proved unsuccessful. Brown spotting of apricots is yielding to boron treatment. In small fruits yellow edge and root rot in strawberry are under investigation, as also cane wilt and crown gall of raspberry. Silver leaf has been found attacking raspberries. Citrus investigations concern rootstocks, varieties of orange, mandarin, grapefruit and tangelo, the dicky rice weevil, hard wax-scale (*Ceroplastes sinensis*) mottling; this condition yields to spraying with manganese.

Miscellaneous investigations (p. 51). Fruit juice trials confirm the previous finding that from Cox's Orange Pippin apples in good condition a juice can be got which retains much of the distinctive flavour.

Fruit cold storage research (pp. 52-4). Data are presented on the storage of Jonathan and Sturmer apples at different temperatures and in different atmospheres. Observations are made on the varying effects of fertilizers on the storage life of 5 common dessert apples, of boron on that of Jonathan, Cox and Sturmer. The effect of prestorage treatment on superficial scald and on deep scald is being examined. Differences in method of precooling Winter Cole pears showed little difference in effect on storage life. Work proposed for 1940 includes orchard storage trials and the erection and trial of a semi-commercial-scale refrigerated gas-store. Another interesting report is that of the Tobacco Research Committee (pp. 54-8) and a very brief one that on Phormium Research (p. 58).

1580. NOVA SCOTIA.

634.11

Sixty-sixth Annual Report of the Nova Scotia Fruitgrowers Association for 1939 and Proceedings of Convention February 13 and 14, 1940, 1940, pp. 110.

The very great difficulties of apple disposal in wartime did not deter the Nova Scotian fruit growers from holding a successful convention at Kentville. Among many interesting papers the following may be noted:—Remarks on the control of the more important apple insects. Orchard management under wartime conditions. Some comments on the fruit growers' wartime policy. Onion growing in Nova Scotia. Nova Scotia Apple Marketing Board Ltd. report and report of progress of Board. Orchard census data as an aid in a planned apple production. Apple storage problems—Mention is made of a new gas-tight building paper known as "Fibrene."

1581. PALESTINE.

634/5

Annual Report of Palestine Department of Agriculture for 1938-39, Part I, 1940 (?), pp. 32, 150 mls (for Parts I and II).

Figures are given showing the remarkable growth in citrus exports in the last five years, oranges rising during that period from 6.5 million cases to 13 million cases, grapefruit from .79 million cases to 2 million cases, lemons from 30,000 cases to 142,000 cases. The main causes of rejection by the Inspection Service, which amounted to 2.5% of the total exports, were in descending order of incidence:—waste, rough skin, physiological breakdown, irregular sizing, fumagine,

bruised fruit. The mealy bug, *Pseudococcus comstocki*, probably a recent introduction, is being studied. As regards other fruits banana growing is declining, while interest in grape growing for table grapes, in melons and in olives is sustained. Increased interest is shown in the cultivation of mango, avocado, loquat, annona and persimmon. The area under strawberries has increased. Boysenberry and youngberry show promise. Vegetable growing is on the increase, the most important crops at present being tomatoes, cucumbers, onions and garlic. The department has devoted work to plum and grape storage, pyrethrum cultivation, new introductions of dates, table grapes and nematode-resistant deciduous fruit stocks, etc.

1582. QUEENSLAND ACCLIMATISATION SOCIETY.

634/5

Seventy-fourth Report of the Queensland Acclimatisation Society, April 1939-March 1940, Brisbane, 1940, pp. 11.

An account of the development of the Society's young trees or plants of the following fruit species:—avocado, citrus, custard apple, pecan, macadamia, mango, mangosteen, lychee, olive, papaw, date, strawberry, pineapple. Other crops under trial are soya beans, sweet potatoes, fodder cane, and various grasses.

1583. TRINIDAD AND TOBAGO.

633.74

Administration Report of the Director of Agriculture, Trinidad, for 1938, 1939, pp. 85, 60 cents.

The following notes on experiments are taken from this report. *Cacao. Spacing experiments* over 13 years with distances increasing by 2 ft. in each direction from 6×6 ft. to 18×18 ft. Yield was about the same per acre for all spacings. In cost and upkeep, however, there were great differences in favour of the closer plantings. Although yield per tree from a 6×6 ft. planting is only one-ninth of the 18×18 ft. a casualty amounts to only one-ninth of the loss. The closer plantings required no shade and formed their own canopy. *Cultivation experiments.* The application of mulch and fertilizers plus draining and roundridging gave greatly increased yields. Draining and roundridging alone were ineffective, the addition of mulch was beneficial, but the greatest increase was derived from the fertilizers. *Budding.* For the particular parent used budded progeny proved better than seedlings. The red-podded parent gave more vigorous and higher yielding progeny than the yellow-podded, whether competing on the same stock or at the same picket. *Manurial.* Annual trenching with debris+pen manure at the rate of 16-20 tons per acre yielded sufficiently to pay for manure and trenching. On a selected site for manurial trials with unshaded cacao results were only obtained with potash, the heavier the application the greater being the increase, thus 900 lb. per acre gave an average increase of 757 lb. per acre as against an increase of 200 lb. per acre for an application of 450 lb. There are many other cacao manurial experiments outlined but space prevents their inclusion here. Most of the results have been published elsewhere and abstracted. *Amherstia nobilis.* This difficult but beautiful tree can be successfully propagated by layering in pots well ripened shoots lightly constricted with wire. Rooting took place in 2½ months and final severance from the parent was possible in 5 months. *Mole crickets.* An infestation of mole crickets which completely denuded a field of grass was within 6 weeks controlled by dusting with "Naga" powder.

1584. TRINIDAD, IMPERIAL COLLEGE OF TROPICAL AGRICULTURE.

63

Report of Governing Body and Principal's Report to December 31st, 1939.

St. Augustine, Trinidad and Broadway Buildings, London, S.W.1, pp. 32, 1940.

The report of the Governing Body is brief, occupying about 1 page. The Principal's report deals with the administrative and educational side. This is followed, pp. 20-9, by short reports from the heads of the various scientific departments on the work done and some of the results achieved. A list is given of scientific papers published between September 1938 and December 1939.

1585. UGANDA PROTECTORATE.

633.73 + 633.72

Annual Report of the Department of Agriculture, Uganda, for year ended June 1939, Part II, 1940, pp. 84, 3s.

Part II contains the reports of the scientific sections. Chief interest for this Bureau lies in the reports of the botanists. The report of the senior botanist deals mainly with cotton, as does

the report of the botanist at Serere. *Coffee*. The report of the botanist at Kawanda contains some interesting remarks on coffee. With native grown coffee it was observed that the *arabica* and *robusta* coffee growing close to the houses was extremely healthy and vigorous and in striking contrast to the poverty of the separate plots. Some of the yard trees were of considerable age and in full bearing, whereas the productive life of native plantation coffee is usually short. The phenomenon is accounted for thus :—(a) the addition of household refuse to the soil is of great value to the coffee, (b) all fertile land is already under cultivation and newly opened land will probably be infertile, (c) the houses are surrounded with banana gardens which provide the right degree of shade to prevent the coffee overbearing, dieback through overbearing being an important problem in Uganda, (d) the shade of the bananas keeps down weeds ; hoeing large plots of unshaded plantation coffee has to be paid for, is consequently neglected and serious damage is done by weeds, especially by the local couch (*Digitaria scalarum*) which can give the coffee a check from which it never recovers. On the experiment station yields of erect types of coffee (*robusta*) have greatly exceeded those of the spreading types (*Nganda*), the former, however, are only considered suitable for European plantations, and are useful for interplanting to give quick returns. Tying out the branches of spreading types has retarded fruit production. Among the progenies of both types in the selection grounds there are considerable differences in drought resistance—drought effect is shown in twisted and contorted leaves which may develop even after the drought has passed. Shade (*Albizia marginata*) has proved more successful in preserving the health of the trees than mulching without shade. The cultivation of *robusta* without shade cannot be made economic, so that selection for exposure is unnecessary ; it appears, however, that the erect *robusta* types with relatively narrow, incurved leaves suffer less than the broad, flat leaved types. *Arabica* coffee had a much shorter root length at all depths (per cubic inch of soil) than *robusta*, especially near the soil surface. Mulched and clean weeded plants suffered little from drought but those under ground cover did so markedly. *Tea*. In theory the Uganda rainfall is too low and the soils insufficiently acid for tea growing. In practice the trees are vigorous and high yielding. Present needs are improved seed selection and a low framework, preservation of soil fertility, anti-erosion measures and manuring. Part II concludes with a brief résumé of a number of experiments, mainly on cotton and coffee, and of the results obtained to date.

1586. VINELAND.

634/635

**Report of the Horticultural Experiment Station, Vineland, Ont.,
for the year ending March 31st, 1939, 1939, pp. 11.**

Short accounts of various projects are given. Cultivation experiments in apple orchards indicate that the cultivation given by most growers is economically excessive. It may be noted that regular clean cultivation has greatly increased the percentage of autumn drops in McIntosh. Tests in three successive years with Concord grape cuttings gave about 10% better stands from early, i.e. mid-April planting, than from planting 3 weeks later. Six years' trial with pear rootstocks shows that in all but one instance trees on Angers quince are smaller than those on French pear seedlings and in most cases have been more productive. Trees on quince C have been more dwarfed and have borne more fruit than those on Angers quince. Transplanted peach seedlings are in their first year inferior to non-transplanted seedlings. This difference levels out at the end of two years. Tests are in progress on the best methods of building up soil organic matter, whether by growth of green manures or by the addition of straw and legume hay, etc. Breeding work concerns cherries, peaches, grapes and strawberries. Selection of nut trees, especially walnuts and filberts, continues slowly. Vegetable breeding and selection work includes tomatoes, early cabbage, onions, early sweet peppers, melons and rhubarb. Variety and strain tests are reported on asparagus, tomatoes, onions, watermelons, sweet peppers, head lettuce and celery.

1587. CANADA (NUNNICK, F. C.).

083 : 63

**List of publications, Canada Department of Agriculture, Publicity and Extension
Division 1940.**

Publ. Canada Dep. Agric. 526, 1940, pp. 15, being *Fmrs' Bull.* 14.

INSTITUTE OF PLANT INDUSTRY, LENINGRAD.

581.1

Biochemistry of cultivated plants. II. Leguminous and forage crops. [Russian.]

Selkhozgiz, Leningrad, 1938, pp. 417, bibls. for each section, 9.15 roubles.

LENIN ACADEMY OF AGRICULTURAL SCIENCES, U.S.S.R.

632.9

Summary of the scientific research work of the Institute of Plant Protection. III. Viruses and bacterioses, biological method, chemical method and mechanisation. [Russian.]

Selkhozgiz, Leningrad, 1938, pp. 111.

1588. The following leaflets of horticultural interest have recently been issued by the Ministry of Agriculture, London.
MINISTRY OF AGRICULTURE, LONDON.

Linseed as a home-grown crop.

633.854.54

Growmore Leaflet. 13, 1939, pp. 4.**Preserving garden produce for the home.**

664.85.036.5

Growmore Leaflet. 22, 1940, pp. 4.**Storing garden vegetables and fruits.**

664.84/85

Growmore Leaflet. 26, 1940, pp. 4.**Jerusalem artichokes : their cultivation and use in animal feeding.**

635.24

Growmore Leaflet. 29, 1940, pp. 4.**Flax growing under contract.**

633.52

Growmore Leaflet. 31, 1940, pp. 4.**Sugar beet growing for sugar and feeding stuffs.**

633.63

Growmore Leaflet. 34, 1940, pp. 7.**Manure from garden rubbish.**

631.875

Growmore Leaflet. 37, 1940, pp. 2.

1589. The annual reports and similar publications listed below have also been examined.

Fiftieth A.R. Arizona agric. Exp. Stat. for 1938-39, 1940, pp. 102.

MITRA, S. K. (ASSAM).

633.72

Report on tea culture in Assam for the year 1938.

Assam Govt. Press, Shillong, 1939, pp. 13, 6 annas or 8d.

A.R. the nat. Inst. Agric. Botany for 1938-39, Cambridge, 1940, pp. 17.**Fifty-second A.R. Colorado agric. Exp. Stat. for 1938-39**, 1939(?), pp. 64.**Rep. agric. Dep. Dominica for 1939**, 1940, pp. 17, 6d.**A.R. Dep. Agric., Mauritius for 1938**, 1939, pp. 81.**Fifty-third A.R. Nebraska agric. Exp. Stat. for 1939**, 1940, pp. 68.**Scientific reports of the Imperial Agricultural Research Institute New Delhi, for the year ending 30th June 1939**, 1940, pp. 144, 5s. 3d.**A.R. Dep. Agric. N. Rhodesia for 1939**, 1940, pp. 18, 1s.**Fifty-first A.R. Texas agric. Exp. Stat. for 1938**, 1939(?), pp. 281.
63**Report of the Waite Agric. Res. Inst., South Australia 1937-38**, Adelaide, 1939, pp. 120.**A.R. Dep. Agric. Zanzibar for 1939**, 1940, pp. 31, 2s.

633/634

NOTES TO SUBSCRIBERS

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Please send your subscriptions for Horticultural Abstracts, Vol. XI, not to us, but to I.A.B., Central Sales Branch, Agricultural Research Building, Penglais, Aberystwyth, Wales.

(2) INDEX TO VOLUMES I-X.

The ten-year index, for which we have received many enquiries, should be available in the early spring of 1941.

We regret our inability to send out with the present number a sample page and order form. These will, however, be issued as soon as we are in a position to get an estimate from the printers.